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TELEPHONE ENGINEER

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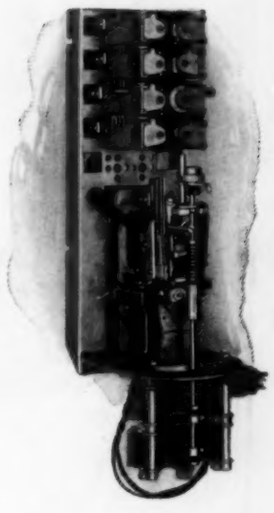

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Life Extension for Poles

Northwestern Bell Expert Has Practical Ideas About Cutting Cedar Pole Depreciation—Compares Methods and Results in Common Use—Advice on Picking Process

By R. M. McCullough

This subject is one of great importance to pole using companies, and for the past twenty or twenty-five years considerable investigation has been made by them to obtain practical methods of accomplishing preservation of pole timber. In this discussion the subject will be considered equally from the practical and theoretical sides. I will bring out for you some of the more important points to be considered by engineers and executives before making the decision to go into the general use of preservative treatment as it is now applied. This discussion will be confined to the treatment of cedar poles, as this timber furnishes practically all of the poles used in this section of the country, and because of its resistance to decay above ground cedar is a good type of pole to butt treat for preservation.

The definition of the term "preservative" as applied to poles, is "the means of preparing the pole to resist decay or change." The reason for treatment is, then, to prevent decay or change and thus prolong the life of the pole. The decay of pole timber is caused by a number of agents, only two of which are important for this territory.

Causes of Decay

Decay is caused by the presence in the pole of bacteria and of low forms of plants called fungi. Of these two, the fungi seems to be the most active. Little is known of the action of bacteria in producing decay, but it is reasonable to assume that the same methods used to combat the fungi will be effective against the bacteria.

Of the great number of fungi and bacteria existant, only a few have the ability to decay wood. There are some that cannot even live on wood. The fungi are forms of plants that are parasitic. Those which produce decay in wood are dependent for their very life on the wood. The reproduction of fungi takes place in two ways: (1) by means of minute spores, and (2) by means of mycelia. The spores, which are similar to minute seeds, are blown about by winds and when they alight on wood, start to germinate and send their minute mycelia into the wood, gradually decaying it.

If the mycelia come in contact with good wood fibre, as when a piece of decayed wood touches a piece of good wood, they grow into the sound wood and start decay. This fact clearly illustrates the desirability of using sound wood for pole skids where poles are to be stored for some time. These root-like mycelia secrete some little understood chemicals which dissolve the wood fibre, the substance of which serves as a food for the fungus. These chemicals are called "enzymes" or "ferments," and fungi differ greatly in their capacity to secrete these chemicals. It is only those fungi which attack cellulose and lignin vigorously that affect the durability of timber to any serious degree. There are four things vital to the life of these fungi, viz., food, air, moisture and a favorable temperature.

Pole Borers Also Cause Deterioration

The "Parandra Brunnea," more commonly known as the Pole Borer, is an elongated, creamy white grub. Probably all of you who have worked on the reconstruction of pole lines have seen this worm at or near the ground line of old poles. It is hatched from an egg, deposited by a mahogany brown beetle about one-half inch in length. These borers on being hatched in the outer layers of the pole, excavate shallow galleries in the sapwood and proceed to enlarge these as they get into the heartwood. The galleries are packed with a fine semi-digested dust, which you have also probably seen. The borer eventually transforms to the adult beetle. The pole borers injure the pole in two ways, first, by destroying the fibre which serves as food, and second, by opening up holes in the poles through which moisture, air and fungi can more easily enter the pole.

As decay producing fungi and pole borers are dependent on four things for their existence, the preservation of pole timber from destruction depends on the removal of one or more of the necessities for life of these organisms. Obviously it is impracticable to remove the supply of air or moisture, and impossible to control the temperature. The remaining point of attack is the food supply. The destruction of this food supply is accomplished by impregnating the wood with some poison that is not injurious to the strength of the pole and is still efficacious as a poison. There are several salts that meet the requirements of disinfecting the pole timber but are soluble in water and hence leach out of the pole, leaving it unprotected.

Creosote the Best Preservative

The best preservative that has been found that meets all requirements as to economy, antiseptic powers and insolubility in water is Dead Oil of Coal Tar, or Coal Tar Creosote. This Coal Tar Creosote is obtained by the distillation of coal tar. This coal tar is produced by the destructive distilla-

tion of bituminous coal at a temperature high enough to yield a tar consisting mainly of compounds of the aromatic series.

In the distillation of the coal tar, the fractions containing the oils that boil at the higher temperatures are the ones that compose the Dead Oil of Coal Tar used commonly for preservatives. The lower boiling fractions composed of creosols and benzines, are more toxic but due to their low boiling point, they volatilize and leach out of the pole cells more easily than do the high boiling oils.

The high boiling oils, composed mainly of anthracenes are less toxic than the low boiling oils but have the advantage of not leaching out so rapidly. There is about a balance, therefore, between the low and high boiling oils as to value from a treating standpoint. The high toxicity of the low boiling oils is offset by the rapid leaching of the oil after the pole has been in the ground. The higher boiling oils have a distinct advantage in one point. Due to the high boiling point of the oil, there is less loss from volatilizing during the treating processes.

There are four methods commonly employed at this time in the preservative treatment of cedar poles. These will be taken up and discussed separately.

Brush Treatment

The brush treatment of poles consists of the application of heated Dead Oil of Coal Tar to the surface of the pole from one foot above to two feet below the ground line. In this treatment two coats of oil are applied twenty-four hours apart. In the brush treatment, checks and knots should be flooded with the preservative to insure disinfection. This type of treatment requires few tools and as it is relatively easy to effect a treatment by this method, it is usually used where poles are to be treated in the field. However, poles must be thoroughly seasoned and must be dry at the time of the application of the oil to permit any appreciable penetration into the sapwood of the pole.

An interesting application of the brush process is in the treatment of poles while standing in the line. Experiments are under way at the present time on this method of treatment, and indications are that the life of poles already set, can in many cases be increased through the application of creosote by the brush method. The most favorable conditions for good results from this method of treatment are present when the pole surface, after the excavation has been made around the pole and all rot or decayed matter has been removed, is found to be free from deep checks and from deep or irregularly shaped pockets. However, there is some question yet as to the economy of this method of treatment, as the expense of applying it is somewhat greater than when the brush treatment is applied in yards.

Submersion Treatment

The submersion treatment of poles consists of dipping the pole butts into a tank of hot creosote and allowing them to remain for fifteen minutes. The oil in this case must be at a temperature between 212° F. and 230° F. No poles are treated by this method that have been exposed to snow or ice within three days of the time of treatment. The submersion and brush treatments are the practical equivalents from the standpoint of penetration varying from a trace to one-fourth inch. More uniform results and better disinfection of checks, knots and incipient heart rot are assured by the submersion process. Both of these methods depend for their penetration on the condition of the exterior of the pole. The poles should be well seasoned and as dry as practicable at the time of treatment to insure any absorption of the oil by the sapwood.

It has been found that case hardened poles do not show good results under either the brush or submersion treatments. Case hardening as applied to poles is caused by too rapid seasoning of the sapwood, and a consequent rapid shrinkage. This causes the sapwood to become hard and brittle. The cells of sapwood that have become casehardened are almost impervious to treatment by dipping only. Winter cuts and summer cuts of timber also vary to some extent in their ability to absorb treatment.

Long Time Treatments

Another type of treatment of poles consists of soaking the butts of the poles in a bath of creosote which is kept at a temperature between 212° F. and 230°F. for a time sufficient to give satisfactory penetration. The time necessary to provide good penetration depends on a number of factors that will be discussed later. This hot bath is followed immediately with a cold bath of at least one hour's duration in creosote, the temperature of which shall not be more than 110° F. for the last ten minutes of the bath.

The treatment under this process takes place in the following manner: The air and moisture in the cells of the sapwood of the pole are driven out by the long bath in hot oil. After the air and moisture have been driven out, the oil is allowed to cool or the hot oil is drawn off and cold oil is admitted to the treating tanks. During the cooling of the oil, a partial vacuum forms within the cells of the sapwood. Atmospheric pressure then drives the oil that has already penetrated the sapwood to some extent further into the wood cells. This action takes place more quickly but no less effectively when the hot oil is drawn off rapidly at the end of the bath and cold oil admitted.

The long hot bath to which the poles treated by this method are subjected has some very desirable features. During the hot bath poles are seasoned to some extent, which helps to eliminate further checking. It is not necessary to protect poles just before this treatment from the action of the weather, that is from snow or rain, as the moisture adhering to a pole is quickly driven off by the hot bath. A real disinfection of any heart rot or skid rot present is assured by this method. The importance of the disinfection of the heart rot will be discussed later.

The requirements of the specifications for this treatment are that the depth of penetration shall not be less than one-fourth inch where the sapwood is one-half inch thick and not less than one-half the depth of the sapwood where it is less than one-half inch in thickness. It is expected that from 75% to 80% of the poles treated under these specifications will meet these requirements. The specifications are so written that they permit 25% of any one batch of poles treated to fall below the requirements as above stated. There seems to be little effect on poles that are case hardened by this treatment. The portions of the pole that are case hardened show little if any penetration of the oil.

Perforation Treatment

The perforation treatment of poles consists of placing the pole in a machine and perforating the butt from one foot above to two feet below the ground line. These perforations are made by a series of sharp teeth that are forced into the sapwood of the pole at evenly spaced points over its surface. The teeth are so spaced that the fibres of the wood are all cut in the space that is perforated. After perforation the pole is subjected to the same type of bath as provided under the butt process.

The theory of the perforation process is that the knives in entering the sapwood open the cells by cutting through them. The subsequent bath in the hot oil results in filling the cells of the sapwood with oil that enters through these perforations and runs axially through the cells after the air and moisture are driven out as explained before under the butt treatment. Early experiments on perforation treatments were based on using

teeth in the shape of a wedge which separated the fibres on being driven into the pole. It was thought that the oil would travel circumferentially between the perforations to effect the treatment and augment the axial travel of the oil. Experience has shown so far that more uniform results are obtained by a perforation that definitely cuts the fibres and this permits of a maximum travel of the preservative longitudinally. While the cutting of the sapwood fibres decreases the strength of the pole, it has been found that this decrease is only about 5% for the smaller poles and less for the larger poles. This decrease in strength is so small as to be negligible.

The specification requirements for penetration under the perforation process are ⅜" minimum where the sapwood is greater than ⅜" thickness, and penetration to the full depth of the sapwood where its thickness is less than ⅜". Very good results are being obtained by the suppliers under these specifications, and uniform results have been obtained over the whole circumference of poles treated by this process. This uniformity of treatment is very essential to satisfactory increases in life of the pole. A satisfactory penetration on one side of a pole may be wasted if a shallow penetration is had on the opposite side of the pole, for once decay sets in it will proceed as fast in the non-disinfected parts of the treated pole as it does in the pole that has had no treatment whatsoever.

Handling Poles After Treatment

Because of the necessity of preserving the relatively thin layer of treated sapwood, in order to derive the benefits of treatment, it is imperative that the field forces use the utmost care in handling the butts of all treated poles. Treated poles should not be dragged along the ground. Pike poles, cant hooks or carrying hooks should not be used in the treated section. Any breaking of the treated section will permit of the entrance of fungi or wood borers.

Advantages of Treatment

Let us now discuss the relative advantages of preservative treatments as applied to pole butts based on experience in actual field trials, together with some of the practical features in connection with the application of these preservative treatments. The preservative treatments just mentioned will be discussed. These are:

a. Brush treatment.
b. Submersion treatment.
c. The Butt treatment.
d. The Perforation treatment.

Experience with the brush treatment on well seasoned pole timber has been that a penetration on the order of 1/32 to ¼ of an inch was obtained. This penetration was obtained under fairly ideal conditions of method and means of application of the treatment. In order to perform the operation of brush treating poles and obtain value from it, there are a number of conditions which it is found difficult to meet. Among these are the matter of obtaining containers suitable for distribution of the oil to the field, the matter of heating the oil, the matter of discriminating in the grades of oil to be used under particular conditions, the matter of having proper conditions as to seasoned poles and dry weather at the time of applying the treatment and the matter of workmanship in connection with the application of the treatment. All of the above require a considerable amount of supervision on the part of the Supply and Construction Department. Under existing conditions, it has seemed that the use of the brush treatment was not entirely practicable when the disadvantages brought about by the conditions under which it is applied are weighed against the expected increase in life received due to the preservative treatment. The increase in life expected by a proper brush treatment is something in the order of four or five years. This increase in life, I believe, would only be obtained where the treatment was applied under ideal conditions.

The field trials of the brush method of treatment have been spread over practically the whole country as this method has been in use for a number of years. We have found from experience in Nebraska that the increase in life of four or five years may be expected. We do have some conditions here that are particularly severe. In the part of the state west of Grand Island and south of the Burlington high line, a serious dry rot attacks our poles. This dry rot is caused by the same agents, it is supposed, as other decay. The decay, however, extends over the entire butt of the pole, instead of only the ground line portion. This is due to the porosity of the soil in this part of the state and the consequent ease of ingress of the fungus life. Brush treatment does not furnish much protection against this type of decay as the entire butt of the pole is not usually disinfected, with the result that heart rot, which is almost always present in a cedar pole, proceeds rapidly after the poles have been set. A recent investigation of a number of poles broken off in a storm between Big Springs and Sidney, Nebraska, showed that the butts were practically all decayed away. These poles were nine years old and were brush treated at the time of placing. Fortunately this dry rot condition does not exist to a great extent in other parts of our territory.

The submersion treatment of poles as described is practically the equivalent of a good brush treatment with the exception that the treatment produced by the submersion method would be more uniform in deep checks and is applied over the entire butt of the pole. This latter provides a disinfection for any heart rot which is present in the pole which would materially aid in offsetting dry rot. This treatment may only be applied to seasoned poles and to be entirely practicable would of necessity require housing or protection of the poles to be treated in order to meet the requirements of the specifications in regard to having had ice and snow on their surfaces and their exposure to rain within less than three days previous to the day of treatment. The added life due to this method of treatment has been found to be in the order of six years. The cost of submersion treatment as compared to brush treatment is about double.

Butt Treatment Adds Many Years

Experimental installations of poles having a penetration of oil on the order of that prescribed in specifications for butt treatments have shown an increase in life ranging from twelve to fifteen years depending on the locality and the exposure. Several lines having poles of this type of treatment have been under observation for a sufficient length of time to substantiate the increase in life expected. These lines have had untreated, brush treated and butt treated poles so interspersed that the action of the soil would be the same on all. One of these lines is in Nebraska, as part of the transcontinental line, between Ashland and Seward.

The perforation process of treating poles is a new process with which little experience has been had. No installations of poles treated in accordance with these specifications have been in service long enough to make definite conclusions as to the increase in life due to this treatment. However, due to the uniformity of depth of penetration and the relative ease with which the penetration is secured, it is reasonable to assume that the added life due to this penetration will be somewhat greater than that obtained through the butt treatment process. Pole suppliers are meeting the specification requirements for this treatment.

The cost of the perforation treatment is something in the order of 4¼

times as much as the brush treatment and is only 10% higher than the cost of the butt treatment. For this increase in cost over the butt treatment together with the dependability and assurance of the penetration of the preservative, the perforation process poles at the present time more nearly meet our requirements and ideals in regard to the preservation of poles than any of the treatments heretofore discussed. For the present at least, the perforation process of treating poles described here is considered the standard method of treating poles in our company, except for reused poles, for which we are buying the butt process due to the results obtained with this particular type of pole.

There is a field, probably, for all of the types of treatments and if the added life given by one method of treatment is found to be sufficient and it is practical to obtain the particular type of treatment desired, that type of treatment might best be used. However, due consideration of the economies of the different types of treatment should be well considered before a choice of treatments is made.

Economy of Treated Poles

The economies of treated poles do not depend entirely in their increased life but are a function of this increase in life. The factor of safety present in a treated pole will remain constant or nearly so for a higher percentage of the pole life than will be the case with an untreated pole. This fact, although hard to evaluate, is clearly indicative of the fact that lower maintenance costs will be effected by the use of treated poles.

These lower costs of maintenance will come from deferred and fewer inspections, resetting and stubbing necessary during the time the treatment is effective in preventing decay. There will probably be some saving in storm repairs due to the relatively high factor of safety present in the poles. This is hard to figure, but will appear after a number of years of experience with a considerable number of the treated poles. Poles treated with good preservative burn slower, than do untreated poles. The requirements of the depreciation reserve are less when treated poles are used due to the increase in life and the consequent longer period required to amortize the investment. This is, however, only a small saving now as the percentage of treated poles will be small for some time.

The indirect effect of the broadcast use of preservative treatments will be to reduce the increasing higher trend of pole prices. It will undoubtedly be some years before this is felt but it is axiomatic that it should follow. This aim is a matter of common interest to all pole using companies and should be a matter of common endeavor.

In general Perforation Process poles will be found economical in the territory including all of Nebraska, Iowa, South Dakota and the southern part of Minnesota. We figure at the present time that untreated poles will be found economical in the remainder of our territory due to the lower rate of decay. It was found from a study a few years ago, that poles in Minnesota had a life somewhat more than we obtain in Nebraska or Iowa. The above conditions regarding economies of perforated poles obtain at the present time and probably will not change for a few years. This matter is, however, being watched very closely to insure the economical use of the treated poles.

Engineering Use of Treated Poles

Let us now discuss some of the points to be considered in engineering the use of perforated poles which are also applicable to poles treated by any method. While the perforation process of treatment is new, it prescribes a penetration of oil that will undoubtedly give an increase in life from 12 to 15 years depending on the locality and the exposure. In considering the use of perforated poles, the probable life should be taken as 15 years more than an untreated pole in the same location.

The economies made possible through the use of perforation process poles will best be realized by engineering our pole lines in such a way that we will realize the value of the life added to a pole through treatment. Permanency of location, then, becomes the governing factor in the use of treated poles. It is reasonable to expect, in the future, that in the case of perforation process poles, the salvage on a pole which has not lived its useful life and is being replaced through obsolesence or inadequacy will be somewhat more than would be the case with untreated poles. This is due to a slower rate of deterioration and recent improved methods for removing and handling poles brought about by the adoption of the pole derricks for construction and reconstruction work.

There are some places in the territory where the obvious thing is the use of perforation process poles. They are:

a. Slow growing toll lines.
b. Farm lines.
c. Cable lines within blocks and joint use lines.

All of these places are subject to the general considerations of permanency of location, etc., mentioned before.

On **slow** growing toll lines in the southern part of our territory where the location of the line is such that a pole may enjoy its full life with reasonable assurance, we consider that the perforation process poles are the poles to use. However, account should be taken of the possibilities of the line being moved on account of road grading or abandoned because of new routings, etc., before the selection of poles is made. In the northern part of our territory due consideration of these points shows that it is highly probable that there will be some lines that will warrant the use of perforated process poles.

On farm lines, particularly in the southern part of our territory, which are properly located **in** or **adjacent** to **fence lines,** perforated process poles will undoubtedly be the economical pole, because the permanancy of location and adequacy for imposed loads is assured here. While the first cost of treating farm line poles is relatively high due to its size and consequent short time for rot, represents an ideal pole to treat.

For aerial cable lines within blocks perforated process poles will generally prove economical in Nebraska. In all cases due consideration should be given to the question of permanency and adequacy. The increasing growth of apartment buildings and the steady expansion of business sections, both tend to the replacement of aerial cable lines with a more adequate type of construction. However, there will surely be a great number of residence blocks whose nature will not change, and where plant should be a permanent fixture as far as this is possible. These cases will usually be in residence districts where, by zoning laws or because of the geographical or topographical locations of the blocks, the plant will be a permanent fixture.

For aerial cable lines along streets, the permanency of the plant is much more open to question than that in alleys or along rear property lines. The extension of underground routes and prohibitive ordinances will tend to make this type of plant less permanent. In the cases where it is assured that the permanency is such that some additional life will be obtained in the order of 20% through the use of perforated treatment poles, they prove economical in these cases, as they defer an expensive replacement of plant for a few years that will more than pay the cost of treatment and will in themselves, represent a high salvage as brought out before.

Roving Creosoting Plant

Telephone Genius Invents Plant on Wheels That Brings the Treatment to the Pole—Operation of Compact Outfit in Storage Yards Successful

By W. F. Norris

(Division Superintendent of Line Construction A. T. and T. Co.)

Courtesy of "Long Lines."

One of the Pole Racks and the Treating Tanks

A Pole Is Being Raised to be Put in Tank

To go into tracts of timber that were formerly made beautiful by many tall, shapely and well-leaved chestnut trees, and to see those same trees with foliage gone and bark falling off in great strips from the effects of the blight, is a sad sight. To save the timber from complete decay these trees are being cut extensively and the supply suitable for poles is rapidly diminishing. It is now necessary to ship poles for hundreds of miles to locations where only a few years ago there were quantities that could be had from woods near the lines.

This shortage, together with the decreasing supply of other timber and the rotting of the poles in the ground, has caused much study to be given to the subject of preserving pole timbers. In the South there are large creosoting plants for the over-all treatment of yellow pine poles and in the West there are permanent installations for treating the butts of cedar poles by the open tank process. Many of the poles have been brush-treated and various other methods have been tried out to preserve the pole near the ground line, as this is the weakest point in the pole after decay has set in, as an accompanying picture will indicate.

Open Tank Process Best Treatment

Experiments have shown that of the several present methods for treating the butts of chestnut poles, the treatment with creosote or dead oil of coal tar by the open tank process is the best.

However, to concentrate chestnut poles in large quantities at a given point and to install a permanent plant for butt treating has not as yet been found economical, as the timber is scattered over a vast area with only a limited number of trees suitable for poles in any one tract. The poles are heavy and difficult to handle and the cost of hauling and transportation is high.

Portable Plant Designed

In an effort to overcome these conditions and to provide a plan whereby poles might be treated in limited quantities of from 500 to 5,000 at loading or storage yards, the Long Lines Engineering Department last June and July issued specifications for the construction and operation of a portable butt-treating plant, which makes it possible to move the plant to the poles instead of moving the poles to the plant. These specifications were turned over to the Line Construction Department of Division 1, to assemble, erect and operate the plant in treating the butts of approximately 2,400 Class "A" chestnut poles of from 25 to 45 feet in length, that had been shipped up from West Virginia to points along the route of the Pittsburgh-New Castle (Pa.) cable pole line. They were well seasoned and were concentrated at Emsworth, Leetsdale, New Brighton, Ellwood City and New Castle. When delivery of the poles was ordered to the several stations it was with the idea of having a minimum haul and with no thought of concentrating them for treatment, or to secure storage yards suitable for the operation of a treating plant. Therefore, to get the space needed for the outfit, it was necessary to shift a number of the poles.

The plant was first set up at Leetsdale as that situation was best for assembling the equipment and meeting the line building program. Most of the views of the plant were photographed there.

It was next moved to Emsworth. At that place there is a high rocky bluff paralleling the railroad and to get a convenient yard the poles had to be hauled to a location back of the bluff.

Above—One of the Tanks in Which the Poles Are Creosoted Being Lowered Into Place
Two of These Tanks Are Now Used

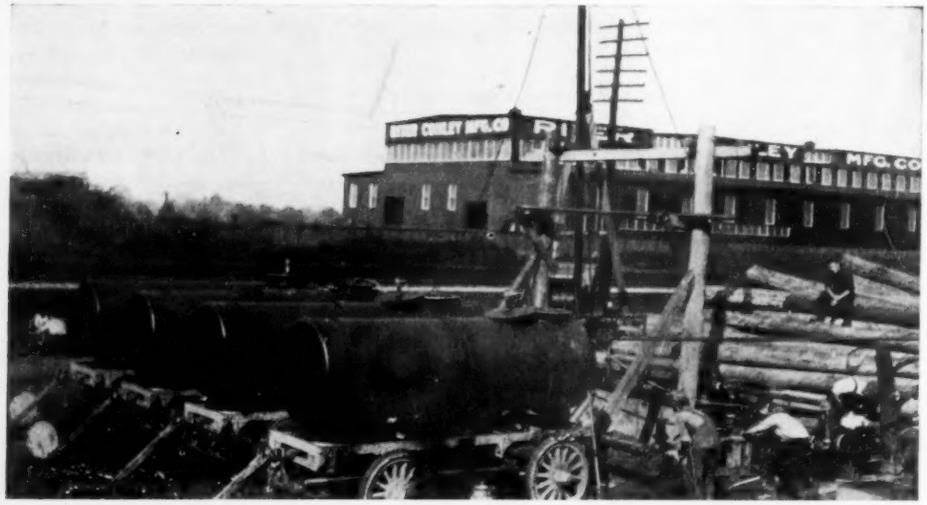
Left—A Two-Tank Set Up, With a Double Rack of Poles

Right—An Untreated Pole. When the Decay Was Removed the Remaining Sound Wood Measured Only 21 Inches, Instead of the Normal 42-Inch Circumference

Left—The Stone Boat Used to Protect the Butts of the Poles While They Are Being Hauled to the Right of Way

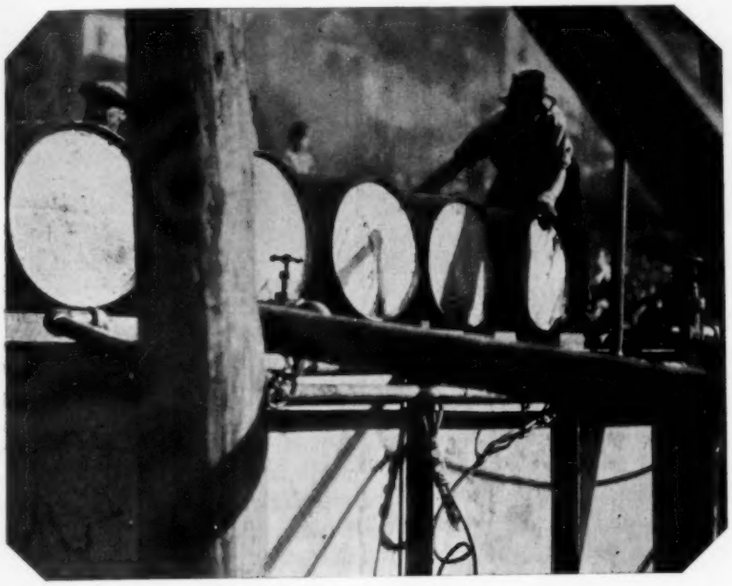
Right—A Pole Removed and Another Placed in the Treating Tank at One Setting of the Derrick

Below—Storage Tanks for the Creosote, Each Holding 800 Gallons



Creek Goes on Tear

The only available place was near an innocent looking creek. While the plant was in operation a series of rains and a cloudburst caused the creek to overflow its banks, and General Foreman James Purtle, in charge of the installation and operation of the plant had to have the poles roped to keep them from being washed down the Ohio River. The water came up so quickly the fires in the boiler were put out and the carburetor of the motor truck was moved to save it. Jim was up to his waist in the raging waters and his assistants were over their boot tops protecting the property. Four of the poles did float off.



The Quickest Way to Get the Oil Into the Storage Tanks Is to Empty It Into the Treating Tank First, and Then Pump It Into the Storage Tanks. This Shows the Oil Being Emptied Into the Treating Tank

Description of Plant

This portable plant is made up of:

Two steel treating tanks, 10 ft. long, 5 ft. wide and 8 ft. deep, equipped with radiators.

Four 800-gallon oil storage tanks, mounted horizontally on 3-ton Troy trailers. Two of these tanks are equipped with radiators.

A 25-h.p. portable steam boiler mounted on wheels.

A pump and engine unit for pumping oil and water.

A derrick with boom mounted on a 3-ton motor truck with power-driven winch.

A pole rack, a portable tool house and piping.

All of these units may be loaded on or drawn by 3 or 3½ ton motor trucks. The entire plant can be readily dismantled and reassembled.

The general set up of the equipment is shown in the photographs. The treating tanks are placed in excavations five feet deep and rest on wooden mattresses. They are located far enough apart to permit the pumping unit to be placed between them. Just back of the treating tanks the pole rack is erected so that when the poles are put in the tanks they may be roped to the rack and kept in a vertical position. The storage tanks are lined up a few feet back of the pole rack and the boiler is wheeled into position near the storage tanks. The truck with derrick is placed so that the poles may be lifted from nearby piles and set up in the treating tank and the treated poles may be lifted out of the tank and placed in piles.

How Poles Are Handled

When an untreated pole is placed in the tank, a treated pole is removed from it so that the derrick does not swing back without load. Before being treated the poles are shaved for about 18 inches above and 18 inches below the ground line and all adhering inner bark or dirt is removed.

In loading or handling the poles with cant hooks care is used not to puncture the treated portion of the pole with the hooks. In dragging the poles over rights of way a sled or stone boat is made to protect the treated butt. The boat is shown in one of the photographs.

The piping is connected so that by a system of gates and valves the oil may be pumped from one tank to another and so that the oil will flow by gravity from the storage tanks to the treating tanks. The steam pipes are connected to radiators in two of the storage tanks, poles are then placed in one of the treating tanks and the hot oil is run into that tank. The pole butts remain immersed in the hot oil for eight hours, when the hot oil is pumped from the one treating tank to the other that has been previously loaded with poles, and cold oil is then run into the first tank. The poles remain in this cold oil for eight hours. It might be possible to get as satisfactory a penetration with a less number of hours immersion in the hot, and in the cold oil, but the eight hour periods worked out to best advantage on this job.

The hot oil treatment removes the moisture from the poles and opens up the cells in the wood in order that the cold oil may be drawn into it. The cold oil closes the wood cells so that the creosote is retained in the wood.

By this treatment of eight hours in hot and eight hours in cold oil the creosote penetrates to a depth of from two to three growth rings or to a depth of at least three-sixteenths of an inch and each pole absorbs approximately 3¼ gallons of oil.

With an absorption and penetration as stated it is estimated that it will prolong the life of the poles about 10 years.

Three Methods of Treatment Tried

In trying out and developing the plant three different methods were used. The first method, using one tank and one gang permitted one treatment per day of from 20 to 27 Class "A" 25 ft. or Class "B" 30 ft. poles having the poles immersed four hours in hot and four hours in cold oil, and having the cold oil flow into the hot oil, keeping a constant level of oil in the treating tank. As it was necessary to bring the temperature of the oil down from 230° to 110°, considerable difficulty was experienced in obtaining this result by this method.

Creosote Skins 'Em Alive

A second method was tried out of having two shifts of men, each shift to work eight hours and to have the cold treatment continue for a longer period than the four hours. It was also found impracticable to get the oil cooled down to the required temperature by this plan or to double the output of treated poles.

This second method was tried out at Emsworth. The second shift of men worked during the night. The plant was lighted by carbic flare lights. Foreman Frank Rice, in charge of the night force, resembled an Indian with his war paint as he went about the tanks with his face and arms covered

(Continued on Page 44)

OPINIONS AND COMMENTS

OUR POLE PRESERVATION NUMBER

In making this a "Pole Preservation" number of TELEPHONE ENGINEER we are doing two things; inaugurating a policy of devoting from time to time to a single general subject, all of the principal articles in one issue, and we are calling especial attention to a subject of much interest in the telephone field.

One of the slogans in the industrial field of today is "eliminate waste." Pole decay is waste and if it can be controlled economically, steps to accomplish this should be taken.

We are confronted not only by the waste of the timber in use for wire supports but also by a diminishing supply. Reports of the available supply of uncut pole timber are somewhat conflicting and sources of supply as yet unknown may be developed but this much is certain that a much greater time is required for a tree to grow to a size suitable for a pole than is required for that same tree to decay if it is cut and set into the pole line without preservative treatment.

Even if the supply of pole timber were sufficient for all time to come, it would still be necessary to study the question of pole preservation. Avoidance of waste requires that our lines be constructed in the most economical manner and, regardless of other matters involved, if the annual charge on a treated pole is less than the annual charge on an untreated pole, economy requires that the treated pole be selected.

As between different methods of treatment and different pole timbers, the one giving the least cost in the long run should be selected, cost being considered to include all of the factors that may enter. Preservative treatment of poles is a development of recent years and experience over a sufficiently long period of time has not been available to permit accurate measurement of all the results. In spite of this, much valuable information has been accumulated which will assist the telephone engineer and manager in the solution of the problem.

In presenting the articles of the present issue, we are following the line of our duty to the industry by giving as wide a distribution as possible to any information of value that is available.

THE FOOLISH FARMER, AND THE TELEPHONE

That inimitable cartoonist, John T. McCutcheon of the Chicago Tribune who is not only an artist and a humorist but is a philosopher as well, has recently told in picture and in story the "Fable of the Foolish Farmer."

As the fable runs, a young man representing a farm paper was trying to convince the farmer that the latter should become a reader of the paper.

After listening to the young man's arguments the farmer finally replied, "Naw, it aint no use for me to read your paper. I don't farm as good now as I know how."

As we have been pondering over the significance of this fable, we have been led to wonder if perhaps this might also be one of the answers to a question we have often asked ourselves as to why some telephone men do not read a telephone paper.

RADIO TELEPHONE'S FUTURE

The report of the Department of Commerce Conference on Radio Telephony indicates that the radio telephone is gradually finding its place and that its commercial development is likely to be along pretty well-defined lines.

While the function of the conference was purely advisory, it is probable that legal enactments will follow closely its recommendations and these laws will have a direct bearing on the development of the new art.

One of the noteworthy recommendations is that the radio communication service be declared a public utility and as such should be regulated and controlled by the Federal Government. Legislation to this effect would immediately place restrictions upon the multiplication of transmitting stations as it would seem that the same theories that apply to the present public utilities would be applied and no second utility of the same kind would be permitted in any community where adequate service is already being afforded by existing utility.

Another important recommendation from the standpoint of the telephone man is that restricting the use of the radio telephone for "point-to-point" communication except in such localities where other means of communication are not feasible. In making this recommendation the Conference recognizes the inherent limitations of the radio telephone as a means of communication between two definite places.

Communication by wire is essentially point-to-point communication or perhaps is even more re-

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stricted than that as is evidenced by the large percentage of person-to-person toll calls in the face of a lower rate for station-to-station service. For this reason, a service which might be called a "multiple message" service has never been highly developed in the wire communication field.

The limited capacity of the ether and the consequent interference between stations when a large number of stations are operating make the radio telephone impracticable for point-to-point communication but its limitation in this respect is the very reason which will cause its development in another field.

Telephone companies, and we believe rightly so, have shown little interest in the possibility of erecting transmitting stations for broadcasting news and entertainment but they should be interested in the commercial phases of the radio field that may be developed.

One of these is the multiple message service which seems to offer possibilities. It does not require any great stretch of imagination to see in the future a radio telephone system maintaining a central transmitting station and leasing receiving sets at a fixed rental per month.

There must certainly be a large number of manufacturing and distributing organizations that could use to advantage a multiple message service to reach local representatives or dealers and that would be willing to pay a reasonable toll for the use of the transmitting station at regular time each day.

The possibilities of this particularly in the larger centers would bear investigation and it is our opinion that such a service if developed should be operated as an auxilliary to the commercial telephone service, rather than as a separate service offered by another utility.

Government Issues Mine Phone Test Schedule

Washington, D. C.—The preliminary draft of a proposed schedule to cover tests of mine telephones to determine their permissibility for use in gaseous mines has been prepared by the Bureau of Mines. The schedule is based on experiments at the Pittsburgh station, which proved that under certain atmospheric and mechanical conditions an electric spark of sufficient intensity to ignite gas could be produced. It has been commonly believed that the mine telephone was perfectly safe in this respect.

Wilmington, Del., Ex-Operators Hold a Reunion

Wilmington, Del.—Harcourt Burns, district traffic superintendent, and Eleanora L. Wieser, chief operator, of the Diamond State Telephone Co., were host and hostess at a reunion of the Diamond State's former operators. Some of those present at the reunion had been out of the service for 20 years.

Ammeters and voltmeters suitable for battery charging outfits, small panels, and similar applications, are described in the recently issued bulletin No. 820 of the Roller-Smith Co., New York.

ONLY 46 YEARS AGO

Forty-six years ago there was one telephone in the world—the instrument which Alexander Graham Bell invented.

Today there are more than 14,000,000 telephones in use in the United States alone.

Forty-six years ago the world's entire telephone plant could have been held in one man's hand.

Today the telephone plants of the United States represent an investment of more than $2,000,000,000, and consist of 21,000 central offices, 34,000,000 miles of wire and a large amount of other equipment.

Forty-six years ago there were two telephone employes — Bell and his assistant.

Today there are 300,000 employes who last year handled 19,000,000,000 communications over the lines of the nation's telephone systems.

Galesburg, Ill., Lines All Sub-Surface in Five Years?

Galesburg, Ill.—F. C. Woods, manager of the Galesburg Union Telephone Co., says all of Galesburg's telephone lines may be underground in five years. An experiment in underground work in residential districts has been begun.

Missouri Commission Approves Kinloch Merger

St. Louis, Mo.—Approval of the Kinloch-Bell merger has been granted by the Missouri Public Service Commission. Three shares of the Bell's 7% preferred stock will be given for two shares of Kinloch common. Merger is expected to be completed in all details in two years. Properties valued at $8,000,000 are affected. Bell's request for an increase in rates was denied.

Grounds Wire on Pump—Shocked by $30,000 Suit

De Kalb, Ill.—Suit against the local telephone company, claiming $30,000 damages, has been entered by a resident of De Kalb, who claims that a telephone wire ground on a pump was responsible for a severe shock to the plaintiff when she attempted to draw water during a recent storm.

New Bedford, Pa., Sold to New Castle Citizens' Company

New Castle, Pa.—New Bedford Telephone Co. has been sold to the Citizens' Telephone Co. of New Castle. About $25,000 is to be spent in rehabilitation of the New Bedford property.

New Ulm, Minn., Company to Put Courtland Line in Shape

New Ulm, Minn.—The New Ulm Rural Telephone Co., which recently purchased the Tri-State lead to Courtland, plans to put this line, which was partially wrecked by spring storms, into A-1 condition, at an expense of several thousand dollars.

Hotel and Travel Directory Big Help to Business Men

Baltimore, Md.—Data on every hotel in the country, travel information and sight seeing and industrial tips covering practically every American community of consequence, is contained in the recently published 1922 edition of the American Hotel and Travel Directory. The volume is widely used by commercial institutions and is the standard reference work of its field. Data on clubs and pleasure resorts also is given, making the Directory a repository of much vacation information. The price of the Directory is $10. Orders may be placed through TELEPHONE ENGINEER.

Chicago alone has more telephones than there are in France, Spain and Portugal combined. Each year the Bell system adds more telephones than there are in France.

WHAT IS YOUR TROUBLE?
A Department of Questions and Answers

Questions continue to flow in to us for answers in this department. The popularity of radio is indicated by the large number of radio questions that we are receiving. We would like to be able to answer all of them but space in a monthly magazine is necessarily limited and we are reluctantly forced to omit some of them.

It is necessary to make the restriction that we can answer in this department only such radio questions as are related to the wire service.

We can care for a limited number of such questions by correspondence and if you wish to send in your query accompanied by a self addressed stamped envelope we will try to be of service to you. In the meantime, let us have your telephone questions. We can be of service not only to you but to others who will get valuable suggestions from reading of your troubles and from our suggestions as to the remedies for them.

Question: Who was the original inventor of multiplex carrier current telegraphy?

Answer: Major General Squier of the Signal Corps was granted the patent on a system of carrier current telegraphy or telephony, which permitted the sending of four message telephoned conversations at the same time on the single wire. The system was developed commercially by the A. T. & T. Co. General Squier is at the present time contesting his patent as he claims infringement by the A. T. & T. Co., and it will be up to the United States Appellate Court to decide this question.

Question: Can the standard subscriber's set be equipped for multiplex telephony?

Answer: The multiplex telephony system invented by Major General Squier of the U. S. Signal Corps may be attached to the standard subscriber's station and is so designed that after the usual connections are made at the central station between the calling and receiving parties portable multiplex telephone sets may be attached at both station and multiplex telephony be carried on by three or four parties without interference and in an entirely secret manner. In the system used by the A. T. & T. Co. the regular subscriber's line is connected to the carrier channel in the long distance central office.

Question: Will an ordinary telephone receiver be satisfactory for receiving wireless broadcasting service?

Answer: An ordinary telephone receiver of 75 ohms resistance is satisfactory for receiving broadcasting service only when such service is sent over the telephone wires with the Central Office battery, of course, in the circuit.

An ordinary telephone receiver of 75 ohms, where used in a regular receiving set, would be found entirely to lack the proper sensitivity for wireless reception.

Question: Are mercerized cotton cords more efficient than soft black cotton cords?

Answer: Electrically, there is no difference as a matter of conductivity. As a matter of insulation it is the writer's opinion that mercerized cotton is a better insulation than soft black cotton. It also gives a better appearance and wears, at least, as satisfactory as the soft black cotton, and since the initial cost is approximately 4 cents more than the soft black cotton, it is universally used in the place of the cheaper cord on all high-grade apparatus.

Question: Would it be possible to use the ordinary telephone and telegraph wires as an antenna for receiving broadcasting service?

Answer: It would be possible to use telephone circuit for this purpose provided a direct connection was made with the radio receiving set through the central office. Unless an arrangement of this kind was made the use of a receiving set across the circuit would flash the signal at the central office, preventing operation of the telephone line.

Question: Is it considered a dangerous proposition to use a receiving set during a thunderstorm?

Answer: Provided the set is equipped for outside and inside lightning arresters the use of a wireless receiving set is no more dangerous than the use of an ordinary telephone during a local thunderstorm. The inductive effect of a lightning bolt striking a set so equipped is, however, a very uncertain factor, and is, therefore, considered a dangerous liability.

Question: Do you consider a patent based on a silicon steel core in a wireless telephone receiver as a new invention?

Answer: As far as we know silicon steel has never been used as a core in receiver coils. It has, however, been used as a core in almost every other type of coil, and because of this fact it is somewhat difficult to state whether a silicon steel core in a receiver coil brings about invention. As far as the writer knows, a similar case has never been contested and if such a contest is made in the Courts it will be difficult to decide the value of such an invention.

Timber Preservation Grows in Importance

Chicago, Ill.—The increased demand for permanent timber structures is shown in a recent report of the Service Bureau of the American Wood Preservers' Association. More than 2,400,000,000 board feet of timber for various purposes were pressure treated in 1921 by the 122 wood preserving plants in operation throughout the United States, thereby surpassing the 1920 record by nearly 17 per cent. Approximately equal amounts were treated with coal-tar creosote and with zinc chloride, the standard wood preservatives. To treat this wood 51,375,360 pounds of zinc chloride, with an absorption of one-half pound per cubic foot, and 79,384,326 gallons of creosote, with an absorption of 5 to over 20 pounds per cubic foot, were required. Ease of handling and the permanence of well-treated wood at low cost are given as the reason for the increased demand. The proper use of a wood preservative adds a new quality to timber which enhances its value as a construction material. The material treated consisted mainly of construction timbers for wharf, bridge, highway, mining and building purposes, piling, telephone and power poles, ties, fence posts, wood blocks for street paving and for factory floors, and timber for miscellaneous uses.

Peking-Tientsin Wireless Now Longest of Its Kind?

Peking, China.—American wireless telephone equipment for use by telephone subscribers in Peking and Tientsin now is in service. This is said to be the longest wireless telephone service open to public use.

Practical Plant Problems

Chapter IV—Suggestions for Preparing House-Count Study

By Charles W. McKay, Associate Editor

In the May issue we discussed the relation of the house-count study to the development study—and also the steps preliminary to the actual recording of data pertinent to the house-count study. It was suggested that suitably scaled maps (maps of a scale of about two-hundred feet to the inch) should be used for recording the house-count data and that all buildings—residences or business blocks—should be noted on these maps.

In the present installment we will take up the consideration of ways and means for treating a specific problem. In Fig. 3 an illustration is given of a block map suitable for recording house-count data. As a matter of fact, the city block depicted in Fig. 3 is reproduced from an actual development study—made by the writer several years ago. The arrangement and classification of buildings, however, has been modified slightly—for the purpose of our present illustration. In other words, the writer has endeavored to present, in the illustration, a block containing property of diversified character—so that most of the problems encountered by the telephone engineer, in ordinary house-count work, may be combined into one illustration.

Referring to Fig. 3 it will be noted that the property at the extreme easterly end of the block is devoted to business purposes and the property at the westerly end is of a high class residential nature. This combination may seem inconsistent to the reader—but, as previously stated, the city block illustrated in Fig. 3 is taken from an actual development study—although the writer has taken the liberty of making certain modifications so that the illustration will be representative of all of the property classifications usually encountered in actual practice.

Due to the fact that the westerly end of the block is of a high class residential nature and the property along the easterly border is devoted to business purposes—it will naturally follow that the residential property along the northerly and southerly block boundaries will diminish in character (from a residential standpoint, though not necessarily in value) as we pass from the west to the east ends of the northerly and southerly boundery streets. The phrase "not necessarily in value" has been used advisedly. On the basis of our hypotheses, the property is still used for residential purposes—and hence that portion of it contiguous to the business district may, for the time being, be less desirable for residential purposes but it may have quite a high value due to the fact that it will eventually be required for business uses.

Still referring to Fig. 3—it will be noted that existing buildings have been indicated by full (unbroken) lines while the probable location of ultimate buildings, on undeveloped property, has been indicated by dotted lines. The location and number of present telephone subscribers has been indicated by the plain numerals; the estimated number of subscribers at the end of the five year period, for each property, has been indicated by the numerals enclosed within the circles, and the estimated number of subscribers at the end of the twenty year period indicated by the numerals enclosed within the squares. In some cases it will be noted that unenclosed numerals, only, have been used—as for instance in the case of the second residence, on the southerly boundary street, from the easterly end of the block. The reason for this will be obvious—when it is noted that the property in question is a single family residence. Unless the building is replaced by a larger structure (devoted to business purposes) it is not probable that the number of subscribers will increase during either the five or the twenty year periods. Of course it is possible that the number of subscribers will decrease—though, in our present illustration, we have assumed that this will not be the case. To avoid confusion, and needless additional detail in recording the field data, it has been assumed that unenclosed numerals represent the num-

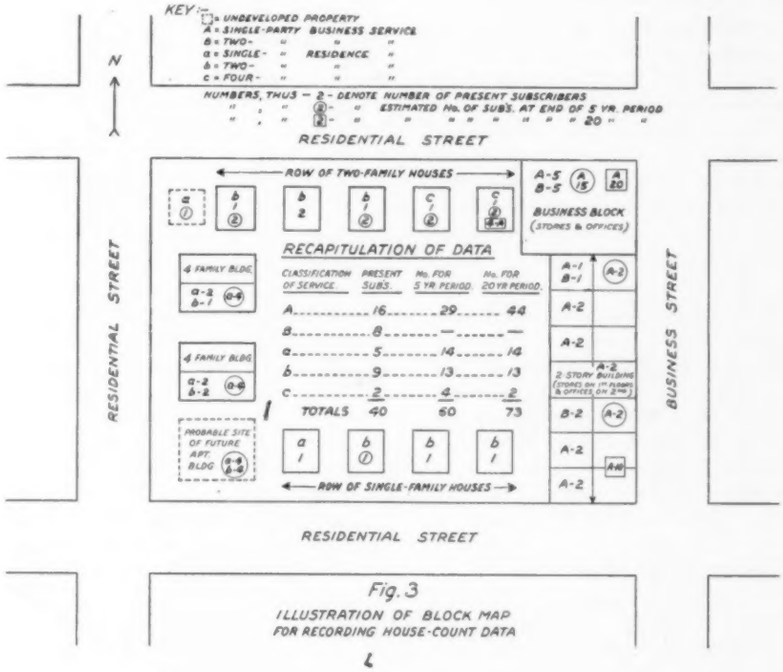

KEY:-
UNDEVELOPED PROPERTY
A = SINGLE-PARTY BUSINESS SERVICE
B = TWO- " " "
a = SINGLE- " RESIDENCE "
b = TWO- " " "
C = FOUR- " " "
NUMBERS, THUS — 2 - DENOTE NUMBER OF PRESENT SUBSCRIBERS
" " " (2) - " ESTIMATED No. OF SUBS. AT END OF 5 YR. PERIOD
" " " (2) - " " " " " " " " 20 " "
N
RESIDENTIAL STREET
ROW OF TWO-FAMILY HOUSES
BUSINESS BLOCK (STORES & OFFICES)
RECAPITULATION OF DATA
CLASSIFICATION OF SERVICE
PRESENT SUBS.
No. FOR 5 YR PERIOD
No. FOR 20 YR PERIOD
A 16 29 44
B 8 — —
a 5 14 14
b 9 13 13
C 2 4 2
TOTALS 40 60 73
4 FAMILY BLDG
PROBABLE SITE OF FUTURE APT. BLDG
2 STORY BUILDING (STORES ON 1ST FLOOR & OFFICES ON 2ND)
ROW OF SINGLE-FAMILY HOUSES
RESIDENTIAL STREET
RESIDENTIAL STREET
BUSINESS STREET

Fig. 3
ILLUSTRATION OF BLOCK MAP FOR RECORDING HOUSE-COUNT DATA

ber of subscribers existant at the date of the survey—and also the assumed number at the end of the five and the twenty year periods. Likewise where numerals enclosed with a circle are not followed by numerals enclosed by a square it has been assumed that the same subscriber development will prevail at the end of the twenty year period as at the end of the five year period.

The writer believes that it will be well worth while to review, in detail, the data presented in Fig. 3. Starting at the upper right hand corner of the illustration—it will be noted that the corner building is utilized entirely for business purposes. It has been assumed that this building is relatively new; of substantial construction, and that it will still be in use at the end of the twenty year period. Let us assume that we are making a survey of the block and proceding in a clockwise direction. The next group of buildings, on the business street, are assumed to be of the two story brick type of construction—the first floors being used for stores and the second floors for offices. In this connection, the thought may suggest itself to the reader that the ultimate number of subscribers (two for each building) is exceedingly conservative—due to the fact that the second floors of the buildings are devoted to office purposes. Such a conjecture, on the part of the reader, would be entirely warranted. To simplify our illustration, however, the writer has assumed that the second floor of each building is occupied by one concern only—or utilized for loft purposes.

The business street, presented in the illustration, may be assumed to be a typical business street in a medium sized mid-western town. We have one substantial office and store building at the north easterly corner and a row of desirable—and therefore reasonably permanent—store buildings extending from the office building to the south easterly corner of the block.

Along the southerly residential street we find a row of four substantial, single-family residences. For obvious reasons, the houses at the westerly end of the block are more desirable than those at the easterly end—and hence a higher grade of residential telephone service may be expected at the westerly end, of the street in question, than at the easterly end.

Along the westerly residential street we find two high class four family apartment buildings. The property at the southwest corner of the block is undeveloped, at the time of the survey, but—after making careful investigations—we find that it will be the probable future site of a high class eight family apartment building. The property at the northwest corner of the block is also undeveloped and in view of the fact that it is too small to permit the erection of an apartment building we feel warranted in assuming that it will eventually (within the five year period) be utilized for single family residential purposes.

Along the northerly boundary of the block we find a row of five reasonably high class two-family dwellings.

Referring to the "Key," accompanying the illustration—it will be noted that the letter "A" has been used to denote single-party business service; the letter "B" to designate two-party business service; the letter "a" for single-party residence service; the letter "b" for two-party residence service, and the letter "c" for four-party residence service.

Again touring the block—and starting, as before, at the northeast corner—we find five single-party business subscribers located in the business building and five two-party business subscribers. After carefully reviewing all pertinent data—our population and subscriber growth curves (as discussed in previous installments); neighborhood conditions, etc.—we feel warranted in assuming that there will be fifteen subscribers in the building at the end of the five year period, all of them utilizing the single-party business classification of service. At the end of the twenty years period we estimate that there will be twenty subscribers to single-party business service.

Considering the next five buildings, on the business street, we find that in each case there are two subscribers, at the time of the survey, some of them subscribers to two-party service but most of them subscribers to single-party service. Our estimates for the five and twenty year periods, respectively, still provide only two subscribers for each building—but, in all cases, it has been assumed that the subscribers will utilize the single-party business classification of service.

Referring to the two buildings at the southerly end of the row—it will be noted that, in each case, there are two subscribers to single party service at the time of the survey and that no change in the number, or in the classification of service, is expected between the date of the survey and the end of the five year period. It has been assumed, however, that our investigation has disclosed facts which warrant the assumption that these two buildings will be replaced—subsequent to the five year period—and that the site will be occupied by a larger building housing at least ten subscribers to single-party business service, before the end of the twenty year period.

No specific comment is necessary with respect to the row of four single family houses on the southerly residential street.

On the westerly residential street—the nature of our hypothesis as to the character of the property—warrants the assumption that all of the subscribers will utilize single-party residential service, at the end of the five year period—with the exception of the proposed apartment building at the southwest corner of the block. In this case it has been assumed that the ultimate development will provide for four subscribers to single-party residential service and four subscribers to two-party resident service.

With respect to the row of five two family houses, bordering the northerly residential street, it has been assumed that the service classification will remain the same throughout the five and twenty year period—except in the case of the building at the extreme end of the row, situated next to the business block. It will be noted, however, that the estimated number of subscribers has been increased slightly in several cases.

It has further been assumed that the exception just referred to (the two family house, on the northerly residential street, located next to the business block) will be affected in the following manner—the classification of service will remain the same during the five year period but the number of subscribers will increase from one to two. Subsequent to the termination of the five year period it has been assumed that the building in question will be replaced by a business block (probably an extension of the business block at the northeast corner) and that there will be four subscribers to single-party business service before the end of the twenty year period.

It may seem to the reader that the foregoing plan of recording house-count data is "far-fetched" and involves a needless amount of detail. It should be remembered, however, that we are considering a more or less hypothetical case—involving numerous assumptions. As previously suggested, the writer has endeavored to picture a typical case—in other words, one which presents a large number, and a wide variety, of problems. With this thought in mind he has, purposely, selected what is, perhaps, the most complicated method of recording

house-count data. There are other, and far simpler, methods. To illustrate—it is possible to use a system of recording data, very similar to the foregoing but one, which provides for the elimination of much of the detail. This system, also, is based upon the use of a block map—but instead of recording, in detail, the various classifications of service and the various estimates as to expected subscriber growth, the investigator classifies the property (using a letter-code exactly similar to the one we have been considering) but does not record an individual estimate as to the future telephone requirements of each property unit. In using this system, however, the investigator does keep a mental record of the individual property-unit service requirements and, after completing his survey of each city block, he makes a summary of service classifications—either on the map itself or on a separate memorandum attached thereto. Furthermore, instead of recording the numbers of existing stations, for each property unit, the investigator merely places a check-mark opposite the service classification letter—whenever he encounters existing service.

The final results of a house-count study, prepared in accordance with the method just suggested, would present an appearance somewhat similar to Fig. 3—if we imagine that all of the descriptive data is eliminated except the service-classification letters. There are many reasons why the method just described should not be used—except by men thoroughly versed in development study work and, even by such men, it should only be used in cases where quick results are desired, with a minimum expenditure of both time and money. The reason for the foregoing statement will be obvious—when it is remembered that the development study, in all of its phases, is essentially an estimate of future telephone growth. It is most desirable, therefore, that an accurate record be kept as to all conclusions—and the reasons underlying these conclusions—so that if the originator of the study is not available for future conferences the company will at least have an accurate record of "what he did and why he did it." It should be remembered that, in many instances, development studies are referred to years after the original survey has been made.

Another short-cut method of recording house-count data is the so-called "color-code" method. In using this method, a map similar to the one suggested in Fig. 3 is used and the telephone classifications are indicated by the use of various colors. To illustrate—blue may be used to designate single-party service; red for two-party service, and green for four-party service. Business and residence service classifications may be segregated by some distinctive marking—for instance, the squares representing various buildings may be shaded with parallel lines to designate business service classifications—or vice versa.

The method just suggested is subject to all of the criticisms referred to in connection with the previous short-cut, letter-code method and has the additional disadvantage of being impractical, for obvious reasons, from the standpoint of rapid and efficient prosecution of the field work.

Another short-cut method that may be used by experienced engineers—where the speed factor is paramount—is the following: A small scale city map (one of about six hundred feet to the inch) may be used as a guide. Before the field work is started each city block should be bi-sected by a pencil line parallel to the longer dimension of the block—unless the block is already bi-sected by an alleyway, or a property line, distinctly indicated on the map.

In connection with the guide-map the investigator should use a note book of convenient size. The pages of the note book should be ruled so as to provide columns for the various business and residential service classifications. In traversing a given street the investigator will note the numbers of the houses—as found in each pair of blocks (in other words on both sides of the street)—both on the map and in the note book. One page of the note book can be used for one side of the street and the opposite page for recording data referring to subscribers on the other side. The data for each house will be recorded in the proper service classification column in the notebook.

The method just described has many advantages—in that it provides a speedy method of recording data, without appreciably sacrificing accuracy.

Referring again to Fig. 3 it will be noted that recapitulation of all data has been made in the vacant interior-block space. This recapitulation shows the present number of subscribers; the number estimated at the end of the five year period, and the number estimated at the end of the twenty year period—for each classification of telephone service. The totals are also shown at the foot of each column.

Knowing the number of subscribers stations estimated for the five year period, and also for the twenty year period, our problem resolves itself into one of determining the ratio of stations to lines for each service classification and the transcription of the resultant data on to a larger scaled map—a map that can be used in connection with the "Fundamental Plan."

Of course, all single-party service requires "a line per station." The ratios of two and four party stations to lines may vary for the five and twenty year estimates.

For the benefit of the readers of this series, who are not thoroughly experienced telephone men, it may be said that a "line", in telephone parlance, is usually assumed to refer to a pair of wires between the subscriber's premises and the main-frame in the central office. At first thought, to the uninitiated, it may seem that one pair of wires, only, will be required for each group of two-party stations and one pair of wires for each group of four-party stations. In actual practice this is far from being the case—for reasons which should be apparent from the following discussion. Party-line subscribers' stations are not usually so located that two two-party stations can be assigned to every two-party line and four four-party stations to every four-party line. In actual practice, many two-party lines must be maintained, at least for the time being, for the service on one two-party subscriber. Similarly, many four-party lines are maintained, for long periods, for the service of three, two, or possibly one, four-party subscriber. The reason for this will be obvious when it is remembered that geographical conditions impose a very real barrier to the "saturation" of party-line circuits. Again, it is always necessary to maintain certain spare facilities to provide for future party-station growth. Other things being equal, the more party-line subscribers, in a given area, the fewer the circuits—or "lines"—that will be required to serve this area. It is for this reason that the statement was previously made that more lines will be required to serve a given number of stations at the end of the five year period than will be required to serve the same number of stations at the end of the twenty year period. As a community grows, and the telephone business develops, it is often possible to affect a more economical distribution and, hence, a greater concentration of party line service. Perhaps a fair average ratio of two-party stations to lines is 1.5 for the five year period and 1.6 for the twenty year

period. On the basis of the same hypothesis a ratio of 2.5 for four-party stations to lines may prove equitable for the five year period and 2.7 for the twenty year period.

In the July installment, the consideration of the house-count study will be concluded with a brief discussion of ways and means for "sizing up" business and residence property and a word of emphasis will be added as to the importance of the house count phase of the development study. We will then proceed to a consideration of the "Fundamental Plan.'

Westinghouse Year's Sales $100,000,000

Pittsburgh, Pa.—In spite of adverse conditions sales of the Westinghouse Electric & Manufacturing Co. for year ending March 31, 1922, amounted to almost exactly $100,000,000. This is the largest volume of business handled by this Company except during the abnormally active previous three years. Manufacturing costs were high, however, as these could not be reduced as rapidly as prices fell. Furthermore, the expense of development work and about $1,500,000 for depreciation of inventory were charged against manufacturing costs, so that the increase in surplus was only slightly greater than the amount paid out in dividends. In addition an increasing demand for the regular lines of products, the large demand for radio telephone receiving apparatus recently developed has prospect of continuance for an indefinite period.

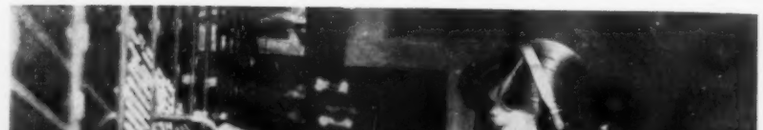
"Queen of Sheba's" Phone Bill $18,000 —Has Own System

New York City—A private telephone system costing $18,000 was constructed for use in filming a recent movie, "The Queen of Sheba." Eight miles of wire were strung that Director J. Gordon Edwards might have perfect control over the thousands of extras scattered about the rebuilt Jerusalem. A crew of 25 trouble and construction men and eight operators were kept busy for two months, according to the industrious press agent.

Illinois Bell Press Service Model for Live News

Chicago, Ill.—Telephone Press Service, issued by the Illinois Bell Telephone Co., has a June issue that all telephone publicity men will read with interest and profit. The material selected for broadcasting to newspapers is well selected. A copy of this model bulletin may be obtained by writing John Spellman, head of the Illinois Bell publicity department, at Chicago.

With Our "Brown Brethern"



Photograph by Fotograms

"Long Chin's Line Is Busy"

"East is East, and West is West, and never the twain shall meet." Kipling muffed one when he wrote this. East and West meet at the San Francisco "Chinatown" exchange of the Pacific Telephone and Telegraph Co. These girls from the Celestial Kingdom have a regular job as the 8,000 calls each day are made by name and not by number. The exchange building is said to be the most beautiful example of the Chinese style of architecture in the United States.

Photograph by Gwilliams

Tokio Telephone Toilers

Men are cheaper than machinery in Jap construction work, hence the crew shown on a stump-pulling job. The circular design on the back of the foreman's coat indicates his union affiliation. Japanese construction gangs are reputed to be willing workers, but now getting rather bolshevistic. Strikes now are occurring frequently. If this gang strikes a live salesman of American pole line maintenance and construction material could show their boss how to get along better without them.

Hoosiers Guard Commission

Northeastern Indiana Telephone Meeting Opposes the Threatened Return of Local Political Squabbling— P. J. Maloney Named President at Successful Gathering

Fort Wayne, Ind.—The Spring meeting of the Northeastern Indiana Telephone Assn., held in Fort Wayne, May 23, was well attended. Snappy business talks and technical demonstrations held the attention of members and visitors.

President P. J. Maloney, Columbia City, opened the meeting, acting as chairman throughout the day. Senator W. E. Bowers delivered the address of welcome in place of Edward M. Wilson, Director of the Home T. and T. Co., who was called out of town the day before. The Senator extended to the convention a hearty welcome, in behalf of the Chamber of Commerce and the Home T. and T. Co., and also a standing invitation to meet as often as possible in Fort Wayne in the future. Upon conclusion of Senator Bowers' address, Honorable H. A. Barnhart, President of the Indiana Telephone Assn., was announced as the next speaker.

In a most interesting manner, Mr. Barnhart touched upon many subjects incident to, and of great importance to the telephone business, particularly urging the improvement of toll service and the construction of first-class toll lines as the means of accomplishing best results in this respect. He also called attention to the present agitation among the public in general to abolish the Public Service Commission and requested that every telephone man exert his influence at the next election, and work for such candidates who are favorable to the retension of the Indiana Public Service Commission. At the conclusion of his address, Mr. Barnhart extended an urgent invitation to all present to attend the telephone meeting to be held at Lake Wawasee, June 14, 15 and 16.

Following Mr. Barnhart, Charles S. Norton, of the Indiana Bell Telephone Co., Indianapolis, addressed the meeting. In the course of his remarks, Mr. Norton also sounded a warning in regard to the danger of the abolishing of the Public Service Commission through political influence, recalling to his hearers the troublesome times when all utilities were at the mercy of local administrations, with all the uncertainties of political intrigue, and annoying demands of the successful political parties who happened to be in power. Mr. Norton's address closed the morning session and the meeting adjourned for luncheon.

The greater part of the afternoon session was devoted to the discussion and demonstration of Wired Wireless by Chester I. Hall, research engineer of the General Electric Co. E. L. Gaines, Traffic Superintendent of the Home T. and T. Co., introduced Mr. Hall to the meeting, complementing him highly on his profound knowledge and successful research work in the art of radio transmission and his conscientious and efficient work while in government service during the war. As a matter of detail, Mr. Hall was able to demonstrate to his audience the wonderful possibilities of radio transmission, particularly in its relation to the telephone business. He illustrated the possibilities of utilizing the telephone circuits for the transmission of radio waves and the possibilities of giving radio service through the telephone apparatus to the subscribers. Although Mr. Hall's demonstration lasted over an hour and a half, he held the attention of his hearers to the very last, and the lively discussions following Mr. Hall's demonstration proved conclusively that his hearers were greatly interested in the subject and were sincere in their expression of appreciation at its close.

Senator Bowers, as Chairman of the nominating committee, reported the following nominees, who were unanimously elected. For President: P. J. Maloney, Manager Whitley County Telephone Co., Columbia City; for Vice President: C. L. Knipple, Manager Huntington, Indiana, Exchange, Huntington, and for Secretary-Treasurer: Martin Umbach, Toll Commercial Supt. Home T. and T. Co., Fort Wayne, Ind. As chairman of the program committee, the chair appointed Mr. Martin Umbach, advising him to select such additional members to this committee as he saw fit.

As a fitting conclusion of the convention, Max Hosea, treasurer of the Indiana Telephone Assn., aroused the enthusiasm of the audience by staging a regular inspiration meeting, calling upon each to introduce himself and to give an account of his telephone experience, he succeeded in furnishing an interesting half hour of entertainment for the convention, at the same time accomplishing the desired results of getting each other acquainted. In his closing remarks, Mr. Hosea claimed this convention to have been the best and most enjoyable of his life.

By request of the Chairman, W. S. Vivian, Manager of the Department of Public Relations, for the Automatic Electric Co., spoke briefly upon the benefit and importance of retaining good relations between the managers of the telephone companies and the public, advising a friendly and congenial attitude of the manager towards his subscriber and the public in general.

In connection with the association meeting, an operators' school was held under the auspices of the association. The school was under the direction of Miss Marguerite Shea, chief observer of the Indiana Bell Telephone Co., assisted by Mrs. Kitty Williams, chief instructress of the Home T. and T. Co., and was conducted along practical lines of operating, explaining in detail the correct and complete makeup of the toll ticket. This was illustrated on the blackboard, and all phrases, codes, notations of time and reports were correctly written in their proper places and explained to the operators.

E. L. Gaines, Traffic Superintendent of the Home T. and T. Co., opened the school with a short speech of welcome.

During the day W. S. Vivian, one of the very first to promote the systematic teaching of toll operating by means of operator schools, and who has possibly done more to improve and systematise independent toll operating than any one man in the independent telephone field, addressed the young ladies on the subject: "The Invention and Growth of the Telephone."

In the afternoon F. V. Newman, General Manager of the LaPorte Telephone Co., spoke upon the good to be gotten out of operators' meetings, and advised the operators to show the proper spirit and pass it along to the operators who were unable to attend.

After the close of the session, the operators visited the local and toll operating rooms of the Home T. and T. Co. and the toll operating room of the Bell Telephone Co.

Valuation in Rate Making

Chapter V—Regarding the Inventory. (Continued)

By Charles W. McKay

In the May issue, we began the study of the inventory—and inventory-recording methods. Before proceeding further it may be well to pause for a moment and consider, briefly, the order in which the work of recording the inventory is usually prosecuted—and the reasons therefor.

It will be remembered that, in the last installment, we introduced the discussion of the inventory problem with a consideration of the pole and wire plant—in other words, the 241, 243, 251 and 253 accounts. This was due to the fact that, in the majority of telephone appraisements, the pole and wire plant is the first to be considered. There are two reasons why the pole and wire plant is usually given precedence over the other elements component to the total telephone property. In the first place, from the standpoint of detail and also from the standpoint of time required for recording inventory data, the pole and wire plant is the most involved. Secondly, as suggested in a previous installment, the weather presents a very real problem to the appraiser of telephone properties.

For these reasons—and most especially from the standpoint of weather conditions—it is customary to record the inventory of pole and wire plant before taking up other, and possibly more difficult, phases of the inventory task.

The writer would suggest the following order for prosecuting the work incidental to the recording of the inventory:

1. The inventory of the rural and toll plant.
2. The inventory of the city pole and wire plant.
3. The inventory of the aerial cable plant.
4. The inventory of the underground conduit plant.
5. The inventory of land and buildings.
6. The inventory of the central office equipment.
7. The inventory of materials and supplies; general equipment; furniture and fixtures, and other miscellaneous property items.

The foregoing schedule is laid out on the assumption that the work is to be started under favorable weather conditions, and that the appraisal engineers wish to "make hay while the sun shines." In carrying out this program it is further assumed that the appraisal engineers will determine as accurately as possible—in advance of the actual starting of the work—the general road conditions in the outlying country. Still assuming that weather conditions are favorable, at the time the appraisal is started, it is well to obtain all available information as to roads that are likely to be bad during inclement weather. Obviously, telephone plant bordering such roads should be inventoried first—in other words, under the most favorable weather conditions.

Having a general idea as to the topography of the country—and as to the road conditions—the engineer will be able to so plan his work as next to provide for the inventorying of plant bordering roads which are apt to be reasonably passable — even during moderately inclement weather. Under this catagory will fall most of the "state" and "country" roads—in other words, the roads built of concrete, Macadam or surfaced with "Tarvia," and other similar road-surfacing materials.

After the toll and rural plant has been completed—still assuming that the weather conditions are favorable—the inventory of the city, or town, pole and wire plant will be prosecuted as rapidly as is consistent with good workmanship.

Next in sequence, comes the aerial cable plant and finally—in so far as the outside plant is concerned—the underground conduit system.

With the inventory of the above enumerated portions of a telephone property completed—the appraisal engineer has little to worry about, from the standpoint of weather conditions. The inventory of buildings, central office and subscribers' equipment, materials, supplies, genral equipment, etc., can be prosecuted under even the most unfavorable weather conditions—for obvious reasons.

The program for recording the outside plant data, as enumerated in the foregoing schedule, was predicated upon the assumption that the work was to be started under favorable weather conditions. Should it develop that interruptions to the outside work are caused by inclement weather—the men of course can be transferred to the task of inventorying inside plant (central office equipment, etc.) until the weather conditions become more favorable. Or, it may be that the weather will become too inclement to permit work in the outlying rural districts (on account of road conditions, etc.) and yet be favorable enough to warrant transferring the men to outside work in connection with the inventory of the city pole and wire, aerial cable or underground conduit systems.

Returning to the consideration of the inventory of the city pole and wire plant—as discussed in the May issue—it will be remembered that a field form, similar to the one illustrated in Figure 5, should be used in connection with a field map—of the type suggested in Figure 6. It will not be necessary to reproduce figures five and six in this issue—as we have nearly completed our consideration of this phase of the subject. It is suggested, however, that the reader refer, briefly, to figures five and six as presented in the May issue.

Cross-arm data should be recorded in the columns headed "Cross-arms." As suggested, by the Form, the double-arms should be segregated from the single arms, and each classified according to type—i. e., "Ten-pin Standard," "Ten-pin Telephone," "Six-pin," etc.

The next two columns on the data sheet provide for the recording of the wood and metal brackets. Wood brackets are usually of standard form and it is thought that no especial comment is necessary with respect to this phase of the inventory. The metal brackets, however, may be of many and varied types. Should this prove the case several columns should be provided—for the metal brackets—one for each general type.

The last six columns on the field data sheet are for the line wire. Rather than to have the captions for these columns printed (or mimeographed) on the data sheet it is better to leave them blank and fill in such descriptive data as may be necessary to identify the various types of wire—as encountered in the plant under appraisement—before the field forms are turned over to the working forces. For illustrative purposes, however, sample captions have been shown in the illustrative form presented in Figure 5.

In recording the data descriptive of the wire plant—it is only necessary to record the number of "spans" between each pair of poles in the properly designated columns. To illustrate, more specifically, if we are recording the pole data for pole No. 22—the wire data for all spans of wire between pole numbers 21 and 22 will be entered opposite pole number 22, as shown on the field sheet.

In conjunction with the inventory of the pole and wire plant it will be necessary to make frequent measurements, between poles, to ascertain average span-lengths. Then, given the number of spans of wire and the average span length it is a comparatively simple task to compute the total lengths of each kind and type of wire. The number of spans multiplied by the average length will give the total quantities. At first thought, it may seem that this method of determining wire lengths is inaccurate and crude. Should such a thought suggest itself to the reader, the writer would advise him to take a definite section of his own pole and wire plant—measure up the total amount of wire in detail; subsequently, measure enough spans to obtain the average span length, and compute the total quantities by the method already suggested. If the reader will then compare the results it is thought that he will find that the "average span method" affords remarkably accurate results—with a minimum expenditure of time and labor. In this connection it should be remembered that much of the wire encountered in the ordinary city distribution plant is iron wire and that, therefore, it would obviously be a waste of time (and expense) to measure accurately each foot of wire.

For obvious reasons, forms suitable for the inventory of city pole and wire plant would prove most unsuitable for the recording of rural data. The reason for this will be apparent when it is remembered that the value per mile of city pole and wire plant is, usually, very much greater than the value per mile or rural plant. Hence, more detail must be recorded in connection with the city plant, and, conversely, much detail may be eliminated in recording rural plant—and the field forms may be correspondingly simplified. Furthermore, a telephone exchange having four thousand city poles may have several hundred thousand rural poles. The rural plant, however, is always of a more uniform type of construction—so that the inventory forms can be made much simpler than the city forms, without materially affecting the accuracy of the final results.

A field form suitable for use in connection with the recording of rural plant data is suggested in Figure 7. This field form is to be used in conjunction with a township, or county, map of the type illustrated in Figure 8.

The pole and wire data may be recorded at quite a rapid rate—usually by using an automobile. "Runs" of poles—often several miles in length—may be recorded at one continuous

Inventory of Pole and Wire Plant
Rural Lines
(Exch. Acc'ts 241 & 243-Toll 251 & 253)

MAP NO.___ SHEET NO.
FIELD WORK
NAME DATE
RECORDED BY
CHECKED BY
COMPILED BY

LOCATION		POLES								CROSS ARMS				MISC.				LINE WIRE (SPANS OF WIRE)					CONDITION		
		HEIGHT IN FEET								SINGLE		DOUBLE													
FROM	TO	20	25	30	35	40	PAINTED	STENCILED	SPECIAL SETTING	10 PIN	6 PIN	10 PIN	6 PIN	ANCHORS	GUYS	BRACED POLES	BRACKETS	#12 BARE	#10 COPPER	WEATHERPROOF	TWISTED PAIR	POLES	X ARMS	WIRE
1	2	INV III	INV	II	I	I	0	3	2	INV INV	INV	I	I	INV	2	I	INV INV	60 30	60	10	5	G	G	G
2	4																							
4	5																							
4	6																							
3	2																							
ETC.																								
TOTALS																								

Fig. 7
Sample of Field Form for Rural Pole & Wire Inventory.

operation, by the use of the field form suggested in Fig. 7 in conjunction with the field map as shown in Fig. 8.

To illustrate, referring to the first line of the field form (Fig. 7) the points "1" and "2" may be several miles apart. With the aid of an automobile, the appraisal engineer should be able to accurately record all of the pole, cross-arm and wire data in a half an hour's time—at the very outside.

Rural lines are usually constructed of 20, 25 or 30 foot poles and carry relatively few cross-arms and wire circuits. Using pole-counters, the engineer will be driven from point "1" to point "2" and, as he traverses the line, he can readily record the necessary data—as he passes each pole—by placing a "check" mark in the proper column on the inventory sheet. It will be noted that the first line of the inventory sheet—as presented in Fig. 7—has been filled in to illustrate the method.

Knowing the number of wire circuits, the wire lengths may be obtained by scaling the maps—after the engineer has assured himself that the maps are accurate.

One point which should be kept in mind, especially, in connection with the inventory of the pole and wire plant is the necessity of determining a strict line of demarcation between "city" plant and "rural" plant. Many telephone appraisal engineers have made the mistake of assuming that all plant without the city limits (or the corporate limits, if one is dealing with a town or village) should be inventoried as rural plant. The writer has known of several instances where an appreciable portion of the city exchange plant was entirely outside of the city boundries. In one Illinois town, of appreciable size, a river practically bisects the town. For some reason, the portion of the town lying to the North of the river has never been taken into the Municipal corporation—despite the fact that this Northern section is thickly settled and the telephone subscribers, in this section, pay for exchange service at the regular city rates.

In the case just cited, practically all of the section North of the river was inventoried as "city" plant—for obvious reasons. It is thought that this illustration will suggest to the reader a means of segregating city from rural plant—disregarding corporate boundaries or city limits. To be more specific—in solving your own valuation problem determine what section, or

sections, lying without the city limits, are cared for through the medium of city exchange service and classify all pole, wire and cable plant, in these sections, under the general classification of "City Property."

The line of demarcation between the city and rural plants should be determined in advance—before the engineers are sent into the field. While the foregoing rule—as to the distinction between city and rural plant—is an excellent one for general use, needless to say, there may be exceptions. Take for instance the case of an essentially rural line which carries one or two circuits feeding subscribers located a half mile or so beyond the usual city service limits. It may be that these subscribers, for reasons best known to themselves, wish to receive individual line service—at the regular city residential service rates. In a case of this kind, the poles, wire and equipment should be inventoried under the caption "Rural Plant"—in view of the fact, that the line was primarily constructed, and is principally used, for rural service.

In the last analysis, therefore, the problem of determining a line of demarcation between city and rural plant may only be solved by considering the exigencies of the case in question—and the use of good common sense.

To avoid confusion, it is suggested that a red chalk mark be placed upon the last City exchange pole of each pole-line extending into the rural districts. Then, if different crews are employed in the task of recording the inventory of city and rural plant—and if both of these crews have been instructed to watch for the marked poles—the danger of duplication will be minimized.

In a previous installment, the subject of the proper allocation of telephone property, between the exchange and the toll accounts, has been treated in some detail. It will be remembered that property is classified according to "principal use." If there is any doubt in the reader's mind as to this phase of the subject, it is suggested that he review carefully the previous sections dealing specifically with the rules governing the segregation of toll from exchange property.

In closing the discussion of the inventory of pole and wire plant it may be said that an experienced appraisal engineer can record the data for a 150 city poles per day. The rural plant can be covered at the rate of from 25 to 50 miles of pole line per day.

Inventory of Aerial Cable Plant

As a preface to the discussion of ways and means of recording the aerial cable data, it may be well to review the instructions incorporated in the uniform system of accounts as prescribed by the Interstate Commerce Commission. Quoting from the Instructions — "These accounts

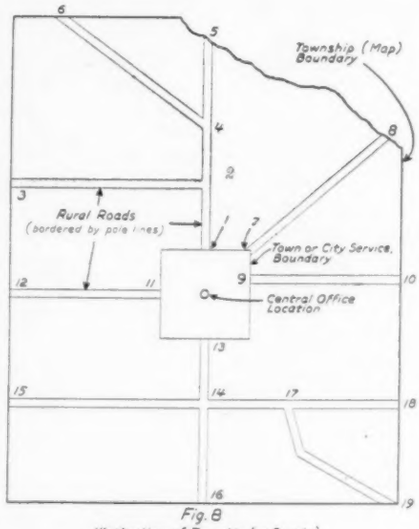


Fig. 8
Illustration of Township (or County) Map to be used with Fig 7

(Account 242, exchange aerial cable should include the cost of cables, including the cost of suspension wire, cable clips and rings, cable boxes and fittings, pole seats and platforms, loading coils, potheads, protectors, sleeves and other material used in hanging such cables."

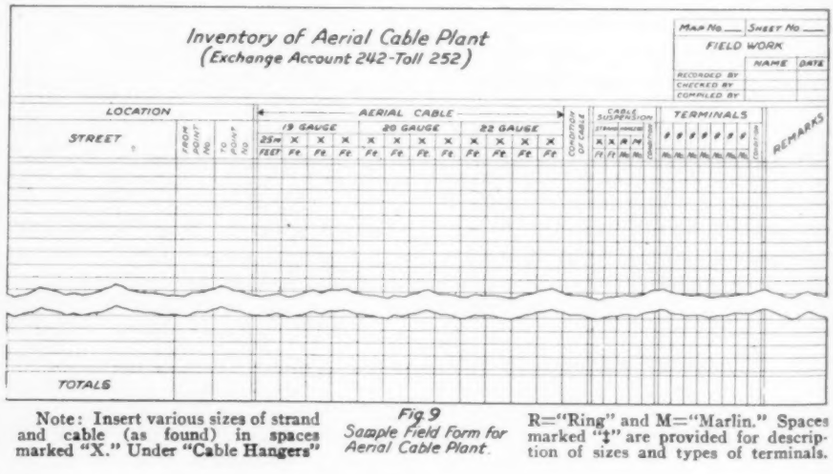
Before starting the actual work of recording the inventory of the aerial cable plant, a careful review should be made of all office records—affording information as to the location, size and gauge of the cables; the location and the size of the terminals, etc. If the aerial cable plant in question is a large one—a map should be prepared showing the location of the cables; and account 252, toll aerial cable) the approximate location of the terminals and giving reference data as to the size and type of all cables and terminals.

The next step, after preparing the maps, suggested in the foregoing paragraph, involves the preparation of a form suitable for recording the field data. Such a form is suggested in Fig 9. It will be noted that the first three columns of this form provide for the location of the various "runs" of cable. It is customary to make a separate record of the cable between each pair of terminals. In some cases, however, it may be found that several cables are encountered on one pole line. In such instances it may be advisable to vary the method of recording the cable sections.

The next twelve columns, on the form, provide for the recording of the measurements for the various sizes and gauges of cable. Another group of columns provides for the recording of data descriptive of the cable suspension equipment—the messenger strand, rings, marlin hangers, etc. Another group of columns is provided for the recording of the cable terminal data. At the extreme right of the form it will be noted that a column has been provided entitled, "Remarks." In this latter column, any supplementary information of a helpful nature may be recorded. Such information may refer to the condition of the cable (especially in cases where the cable sheath has shown evidence of crystallization (or other defects) or it may refer to the inventory data as recorded.

In recording the inventory of the aerial cable plant, the field inspectors should note the following data carefully:

1. Size of the cable—number of pairs of wires.



Note: Insert various sizes of strand and cable (as found) in spaces marked "X." Under "Cable Hangers"

Fig. 9
Sample Field Form for Aerial Cable Plant.

R="Ring" and M="Marlin." Spaces marked "‡" are provided for description of sizes and types of terminals.

2. Gauge of the cable—whether the cable pairs are of number 19, 20, 22 (or some other gauge) wire.

3. The length of each cable—between measuring points. Measurements should be taken with the aid of a surveyor's chain (or steel tape) and pins. Especial care should be taken—in measuring long sections—to obviate the possibility of errors. Cable measurements must, of a necessity, be made by a two-man gang. It is a good plan for both men to keep a record of the lengths, between measuring points, and to compare results before recording the data.

4. With respect to the messenger strand—the material and tensile strength of the strand, the diameter and the length should be noted.

5. In the columns provided therefore—the size and type of cable hangers should be recorded. A segregation should be made between the marlin and ring type of hangers.

6. The size and type of cable terminals should be carefully noted. If the terminals are "protected" a note should be made as to the number of pairs equipped with protectors.

If there is the slightest doubt, in the minds of the field inspectors, as to the gauge of any of the cables, a distinctive note should be made on the data sheet; the diameter of the cable ascertained and every effort made to clear up the doubtful points—through reference to office records and manufacturers specifications. In this connection, it may be said that cables of the same size, gauge and capacity usually have a uniform diameter—although it is true that different makes of cables may vary slightly. Similar precautions should be observed with respect to the terminal equipment.

If the aerial cable plant, involved in your own appraisal problem, is not extensive—the work may be expedited by recording all of the cable, terminal, and incidental, data directly on the map showing the cable lay-out. Subsequently this data can be transferred to, and summarized on, a form similar to the one suggested in Fig. 9.

In the July installment of this series, the discussion of inventory problems will be continued. Inventory methods, and field forms, for recording the underground cable and conduit plant will be discussed in detail.

Wilmington, Del.—Alvord Telephone Co., Capital $25,000. Incorporators: A. O. Hughes, Fort Worth, Tex.; S. C. Pedigo, J. H. Field, St. Joe, Tex.

United of Kansas Grows from 60 Phones to 60 Exchanges

Abilene, Kan. — Extensive improvements have been started by the United Telephone Co. since its capitalization has been increased from $3,000,000 to $5,000,000. Nearly 40 years ago the first of the United exchanges was opened with 60 telephones. The system now has 60 exchanges.

Photograph by Fotograms

Sand Glass Checks Gab

Note the three-minute glass. Great for cutting down those Broadway-Hollywood charges. Mlle. Sascha Beaumont has one on her telephone as three minutes is all each admirer can have. Her classic features don't indicate that the party on the other end of the line is making much use of his sand.

British Telephone Business Has Big Local Call Slump

London, Eng.—At the close of the fiscal year 1921-1922 the British Post Office Department released figures showing that local telephone calls had fallen to 675,000,000 from the 1913-1914 figure of 834,000,000. Trunk calls had increased over the 1913-1914 figure of 38,200,000 to 52,300,000. In Great Britain there is one telephone to 47 people. In London, one to 15.

Ohio Subscribers Agree to Finance Better Service

Eaton, Ohio.—Differences between its former subscribers and the Eaton Telephone Co. are reaching the vanishing point, according to local reports. At a meeting of former subscribers willingness to pay an increased rate was expressed, providing the telephone company put its lines in good condition.

NEW RATE BASIS

New York Case Expert Proposes Use of Modified Book Value

Albany, N. Y.—The City of New York completed the presentation of its direct testimony in the Public Service Commission's investigation of rates charged by the New York Telephone Co. in that city, when three experts testified before the Commission here.

The principal witness was Milo R. Maltbie who proposed new rate making methods for the telephone company. These methods included the abandonment of certain fixed charges of the company and of basing rates on the book cost of the company's properties less depreciation reserve, instead of on the value of the property used in the public service as now prescribed by law. The witness said that with these alterations in the company's practices there should be a reduction of telephone rates in the city, as he contended that the rates now in effect are excessive. His testimony covered a wide range of subjects and he contended, among other things, that the Company's depreciation reserve and working capital was too high, based on his calculations of how the Telephone Company should be operated.

The value of the telephone company's property in New York City was given by the witness as $107,666,352, on January 1st of this year which figure was reached, he said, by taking the company's cost of the property and deducting from that figure an amount which, he said, represented properties built out of earnings.

Mr. Maltbie produced exhibits intended to show that the telephone company's average earnings for the past eight years on an average plant investment for the same period provided an average return of 14.23 per cent under his basis of book cost less depreciation reserve. Nevertheless, the witness showed that under his plan the Telephone Company's earnings in New York City would have been 2.09 per cent in 1920 and 4.46 per cent in 1921. He closed his testimony with exhibits in which he attempted to fix the telephone company's rates for the next two years.

Belgium-Netherland Congestion To Have Early Relief

Antwerp, Belgium.—Direct telephone connections between Antwerp and The Hague will be available in a few months. At present telephone traffic between the two cities is too heavy for the facilities.

South Dakota's Meet Snappy

Mitchell, S. D.—Emerging serene from the storm that has been giving telephone companies a bad tossing in months past, South Dakota telephone men met en masse for the 16th annual convention of the South Dakota Telephone Assn.

The business end of the session was opened by the direct remarks of Secretary-Treasurer J. J. Bollinger, of Bridgewater, who advised adoption of a stronger financial program in order to allow the organization to function in accord with its opportunities.

As a result of the hearty co-operation of the Dakota Central Telephone Co. in supplying means for broadcasting information, the public relations committee of the association was able to report achievement during its tenure.

President J. A. Steninger, of Parker, who was re-elected at the convention, slid the sessions smoothly through a series of papers that set a high water mark for practical value to convention attendants.

C. E. Hall, tax commissioner of the Northwestern Bell Telephone Co., Omaha, gave the assembly expert advice on tax matters. W. S. Vivian spoke on "Public Relations." Another executive of the U. S. Independent Telephone Assn., C. C. Deering, of Des Moines, also addressed the convention.

Following the talk of F. L. Wheeler, of Scotland, on "Underground Cable Construction for Small Exchanges," there was a spirited discussion led by J. J. Bollinger.

The movies got a good play at the South Dakota powwow with W. S. Vivian acting as impressario for the famous "Dial of Destiny," Automatic's reel, and M. E. Guinter, Sioux Falls District Commercial Manager for the Northwestern Bell, presenting one of his company's films. The movie sessions were attended by operators and the public, as well as by the telephone executives, and were very favorably received.

The convention's second day was featured by the addresses of A. S. Kelly, Omaha, Neb., on public relations; A. J. McInness, president of the North Dakota Telephone Assn., and by E. C. Hartley on "Farm Line Switching." Mr. Innes spoke on the operation of a valuable state association, bringing out its definite help to its members.

"Problems of Maintenance and Depreciation" were handled by J. L. W. Zietlow, president of the Dakota Central Telephone Co., Aberdeen, in an illuminating manner.

R. G. Smith, Northwestern Bell's district manager at Chadron, Neb., gave some interesting slants on public relation problems, and was followed in the program by J. J. Murphy, chairman of the South Dakota Railroad Commission, who spoke on the necessity of proper telephone accounting. Further advice on the importance of proper accounting was contained in the address of Hugh Smith, of the South Dakota Tax Commission who laid the blame for incorrect taxation of telephone companies, in most cases, at the door of the telephone company, that failed to supply the commission with proper information.

Papers of "Service Connection Charges," and "How to Best Present Our Case to Our Neighbors and the Public" were read by Thomas Phalen, Superintendent of Traffic of the Dakota Central Telephone Co., and H. P. Hartwell, of the Tri-County Telephone Co., Irene, respectively. "High Tension Electric Line Interferences" gave R. H. Fair, General Superintendent of plant of the Northwestern Bell at Omaha, material for an interesting talk.

Forty-one operators attended the school in charge of A. M. Weise and H. J. Gibbs, of the Northwestern Bell. Miss Alma Christopherson, Mrs. Charles Anderson, Mrs. Gladys Aust and Miss Florence Gage also assisted in conducting the operators' school.

Exhibits staged by Kellogg, Monarch, Stromberg Carlson and National Carbon were convention high lights, with the Kellogg radio demonstration playing to "standing room only."

One of the personal touches of the meeting was the reminisencing of Verne Kennedy, who spoke of his first convention visit, made some years ago with his father, the late Judge C. B. Kennedy, who was one of the leading lights in association work at that time.

Mitchell made the convention welcome by an address of its mayor, and by an orchestra concert.

To steer the association through the ensuing twelve months the following officers were elected:

President, J. A. Steninger, Parker; Vice-President, C. L. Kundirt, Harrisburg; Secretary-Treasurer, Thomas Phalen, Aberdeen.

Directors elected were: J. J. Bollinger, Bridgewater; F. L. Wheeler, Scotland; J. K. Sechler, Faulkton; M. E. Guinter, Sioux Falls.

NAUGLE'S BUTT-TREATISE

Big Cedar Company Issues a Valuable Book on Butt Treatment of Poles

Chicago, Ill.—A welcome contribution to the telephone man's library has been made by the Naugle Pole and Tie Co., in its recently published book, "Butt-Treatment of Cedar Poles."

The why's and wherefore's of butt treatment are covered in an interesting and practical fashion, with many illustrations to add to the clarity of the subject's handling.

Naugle's facilities for butt treatment are described in detail by text and illustrations, particulars of the method of Pentrex treatment which is employed by Naugle, and the life of Pentrex treated poles, are subjects of some especially interesting pages. Specifications of various treatments, and data on strength of treated poles also supply information that is frequently needed by telephone engineers.

A copy of this new Naugle book will be sent upon request by the company.

Grant Injunction Against Rate Decrease in New York

New York City.—Pending the trial of the New York Telephone Co. suit to enjoin the Public Service Commission from enforcing the rates fixed by the Commission's orders of March 23d, an injunction against the increase has been granted the company. In a lengthy opinion the court states the rates proposed by the commission "cannot possibly be a fair return for any business like the telephone business * * * at the present time."

Snatch at New England's Five Per Cent Bonds

New York City.—An oversubscription welcomed a $35,000,000 issue of New England Telephone thirty year five per cent bonds placed on the market late in May.

Wisconsin Bell Employees Sell More Than Half of Issue

Milwaukee, Wis.—According to W. R. McGovern, president of the Wisconsin Telephone Co., more than half of the $5,000,000 stock issue of the company which was over-subscribed in seven and a half days, was sold by the company's own employees.

Tidy Sum Is Illinois Bell 1922 Construction Budget

Chicago, Ill.—Directors of the Illinois Bell Telephone Co. has approved a total construction budget for 1922 of $6,219,548.

Economies of Pole Treatment

Will It Pay You to Treat Your Poles?—Here is a Method of Determining Advisability of Wood Pole Treatment—Applies to Local Conditions

By R. V. Achatz

When several methods of construction may be used differing in cost and expectation of life, one of the most important questions to be decided in making a selection is "which will pay best in the long run?" In some cases the decision can be made entirely on the basis of cost in the long run, while in other cases there are considerations which can not be evaluated in dollars and cents which must be given consideration and which may even overbalance an advantage in cost. In the case of pole treatment, the cost is of primary importance, although there sometimes are other factors which enter. In order to throw light on the economic features of pole treatment, some data are presented as to the cost and economy of untreated poles and poles treated by the different methods. It must be remembered that the figures given may not be applicable to particular cases as differences in the cost of treatment and the life of poles would change the results.

The cost of treating poles varies over wide limits, depending upon the method of treatment, the number of poles treated at one time, the amount of preservative used, the cost of preservative, the cost of labor, the amount of handling of the poles during treatment and other factors. In the case of brush treatment, the conditions vary so much that it is almost impossible to give accurate cost data. The cost may run from twenty to thirty cents for small and light poles to one dollar or more for large poles. The pole companies which operate plants for treating poles have a schedule of charges depending upon the specification under which the treating is done and the size of the pole. At present (September, 1919) the charge for Specification "AA" treatment by dipping in hot creosote ranges from $0.40 for a 4"-20' pole to $4.25 for an 8"-45' pole. The range of cost for Specification "A" carbolineum dip treatment is from $0.50 to $5.25, and for Specification "B" hot and cold treatment from $0.80 to $6.50 for the same sizes of poles. These prices are for treating Northern White Cedar poles.

Whether the additional expense of treating poles is justified is an economic question.

The following article, which is a section in a circular on "Preservative Treatment of Wood Poles," published by the Engineering Experiment Station of Purdue University, discusses this question.

While the costs given may not be applicable for other timbers, in other places or at times different from those given, the methods employed in determining if preservative treatment is economically justifiable may be applied by the substitution of local costs and expected life of poles in the localities where they are used.

Those interested in securing a copy of the complete circular may secure it by addressing the Director, Engineering Experiment Station, Purdue University, Lafayette, Indiana.—Editor's Note.

Additional Life Necessary to Justify Treatment

If comparisons are to be made between construction methods involving different first costs and different expectations of life, it is necessary to reduce the cost data to some common basis. The common basis for comparison in the case of poles is the annual cost of service. Annual cost of service includes the interest on the investment or first cost, the amount that must be placed in a reserve for replacement so that the money expended for first cost is available at the end of life, the amount that must be paid annually for maintenance and the annual cost of operation. The cost of maintenance and the operating expense do not change whether the pole is treated or not, so that interest and depreciation, or payment into replacement reserve, are the only factors that have to be considered in making comparisons.

A convenient method of making comparisons between untreated poles and poles treated by various methods is to determine the annual cost of service of untreated poles and then determine the minimum life of treated poles to give the same annual cost. The difference between this minimum life of the treated poles and the life of untreated poles gives the increase in life necessary to justify treatment. This increase in life necessary to justify treatment may then be compared with the expected increase in life due to the use of treatment as shown by experience, to determine if it is economical to use the treatment.

The results of computations to determine the increase in life necessary to justify treatment are given in Table I. Four common sizes of northern white cedar poles have been selected and the data prepared for treatment by the brush method and by tank methods. While the costs might differ in specific cases from those given in the table, the variation would be nearly proportional and the results would not be changed materially. The costs given are based upon prices as of September, 1919. Prices on poles are based on quotations in carload lots f. o. b. Indianapolis as a central point in Indiana. Labor and other costs are based upon present rates of wages and other expense. No general expense as administration, engineering, interest or insurance, is included. The costs of brush treatment are based on a study of the cost of treating a certain group of poles and on other information available. Costs of the tank treatments are the charges made for the treatment by the pole suppliers.

The estimated life of untreated poles is based upon average conditions in Indiana soils and the amount of depreciation is computed on a sinking fund basis with interest at 4 per cent compounded semi-annually. Interest on the investment is computed at 6 per cent. The life of the treated poles necessary to justify treatment is approximate, being taken at the half year nearest the actual figure.

TABLE I. Increase in Life Necessary to Justify Treatment
Northern White Cedar Poles

Untreated Poles				
Size of Pole:				
Length	20′	25′	30′	35′
Top	5″	5″	6″	7″
Cost in Place (Not stepped or painted)	$2.80	$4.37	$8.35	$15.85
Life in Years	12	14	15	16
Annual Charge:				
Interest 6%	$0.168	$0.262	$0.501	$ .951
Depreciation, 4% sink. fund	.186	.239	.417	.724
Total	$0.354	$0.501	$0.918	$ 1.675
Brush Treated Poles				
Cost in Place	$3.14	$4.79	$8.94	$16.69
Annual Charge:				
Interest, 6%	$0.188	$0.289	$0.536	$ 1.001
Depreciation, 4% sink. fund	.166	.212	.382	.674
Total	$0.354	$0.501	$0.918	$ 1.675
Life in years necessary to justify treatment	14.5	16.5	17	17.5
Tank Dipped with Creosote (Specification "AA")				
Cost in Place	$3.30	$4.97	$9.45	$17.70
Annual Charge:				
Interest, 6%	$0.198	$0.298	$0.567	$ 1.062
Depreciation, 4% sink. fund	.156	.203	.351	.613
Total	$0.354	$0.501	$0.918	$ 1.675
Life in years necessary to justify treatment	15.5	17.5	18.5	19.5
Tank Dipped with Carbolineum (Specification "A")				
Cost in Place	$3.45	$5.17	$9.95	$18.35
Annual Charge:				
Interest, 6%	$0.207	$0.310	$0.597	$ 1.101
Depreciation, 4% sink. fund	.147	.191	.321	.574
Total	$0.354	$0.501	$0.918	$ 1.675
Life in years necessary to justify treatment	17	18.5	20.5	21
Open Tank Hot and Cold Treatment				
Cost in Place	$3.75	$5.57	$10.60	$18.85
Annual Charge:				
Interest, 6%	$0.225	$0.334	$0.636	$ 1.131
Depreciation, 4% sink. fund	.129	.167	.282	.544
Total	$0.354	$0.501	$0.918	$ 1.675
Life in years necessary to justify treatment	19.5	21.5	23	22

For the sizes of poles given, it will be noted that Table I shows that an average increase in life of about two years will justify brush treatment. An average increase of 3½ years will justify the creosote dip treatment, of five years will justify the carbolineum dip treatment, and 7½ years will justify the hot and cold open tank treatment. Table II is a summary of the results of Table I and a comparison with the expected increase in life that may be expected to result from treatment.

TABLE II. Summary of Necessary Increase in Life to Justify Treatment and Expected Increase in Life from Use of Treatment

Type of Treatment	Increase in life necessary to justify treatment	Increase in life which may be expected from use
Brush Treatment	2 years	3 to 5 years
Creosote Dip (Specification "AA")	3.5 years	4 to 6 years
Carbolineum Dip (Specification "A")	5 years	No information available
Hot and Cold Open Tank (Specification "B")	7.5 years	More than 11 years (A. T. & T. Spec'n)

The increase in life which may be expected from treatment given in Table II for brush treatment is taken from the results of the inspections of poles described in another section of the circular and from other information. The increase for the creosote dip treatment is also taken from the results of the inspection. No information is available as to the effectiveness of the carbolineum dip treatment. Experience of the American Telephone and Telegraph Company with hot and cold open tank treated poles in experimental lines indicate that considerably longer than eleven years' increase in life may be expected.

Factors Other than Cost which May Influence Selection

The figures presented in Tables I and II are based on the bare cost of replacement of the pole and include no expense for transferring the wire and fixtures from the old to the new pole in making the replacement. There is, likewise, the factor of interruption to service that must be considered. This may amount to little or nothing on a rural telephone line where replacement may be made without interfering with the operation of the line. On the other hand, the replacement of a high pole on an important high tension power transmission line may involve serious interference with the continuous operation of the line or extra cost on account of having to do the work on Sunday. In such a case, even if the increased life barely justified the treatment, the reduction in interruptions to service would be of considerable advantage. In other cases, the cost of transferring wires, cables, cable terminals, transformers or guys from the old pole to the new may justify the use of treated poles even if there were no advantage at all from the standpoint of cost when only the bare cost of the pole is considered.

Selection of Type of Treatment to be Used

From the data given above, it can be seen that the use of pole treatment can be justified from a cost standpoint. The selection of the type of treatment must depend somewhat upon local conditions. For temporary lines where the life of the line does not exceed the life of the poles, it may be advisable to use untreated poles, especially if the poles are not likely to be reused. Where first cost must be kept down on permanent lines and for small companies which use only a few poles annually the brush treatment has the advantage. The tank dipping treatment with creosote will be justified if a considerable number of poles are to be used and the pole using company does not wish to go to the trouble of doing the brush treating. It is not certain that this treatment should be recommended to smaller companies using less than one carload of poles annually. In this case, some of the poles may not be used for a considerable time after the shipment is received. They may even be held for several years. It is known that brush treatment is not as effective if the poles are allowed to remain in the yard for a long time after treatment and it is to be expected that the same thing would be true of the creosote dipped poles, although no direct information on this point has been secured.

It is questionable whether the carbolineum dipping treatment is advisable. The cost of this treatment is more than the creosote dipping treatment on account of the higher cost of preservative and if a longer lived treatment than the creosote dip is desired, the hot and cold treatment is to be preferred. The great increase in life obtained from the use of the hot and cold treatment will justify this treatment for the more important lines, particularly those using large and heavy poles, where the life of the line is expected to exceed twenty years.

"Story of the Telephone" Is Printed by Automatic

Chicago, Ill.—"The Story of the Telephone," a human interest narrative told at the Kansas Independent Telephone Assn. Convention by W. S. Vivian, manager of the Automatic Electric Co., Department of Public Relations, has been printed in booklet form by the Automatic. Publication and distribution of this booklet is at the request of the officers and members of the Kansas association. Copies of the booklet may be had upon request by addressing the Automatic's Department of Public Relations. The booklet is a masterpiece of good will propaganda and seems destined to have a big distribution.

Penetration of Creosote

American Wood Preservers' Association Committee Tests Effect of Inner Bark on Creosote Penetration of Perforated and Non-Perforated Cedar Poles

By J. D. Burnes

The sections used in this experiment were 6-inch 7-foot posts. The unseasoned samples were received at the plant unpeeled. The seasoned samples had been peeled, leaving the inner bark and strips of the outer bark. The green samples were peeled just prior to the beginning of the experiment.

Areas B and D as shown in the diagram, were then shaved removing all inner and outer bark. Areas A and C were left with inner bark and some strips of outer bark adhering to the wood.

The word "peeled" as used in this report indicates the usual removal of outer bark as performed by pole makers, which invariably leaves strips of outer bark on the pole.

For this experiment the inner bark is defined as that portion of the bark consisting of the cambium and the layer which was alive when the tree was cut. This layer varies from 1/64 to 1/8 inch in thickness.

Condition of the Seasoning of Sections

Section 1. Northern white cedar fully seasoned.

Section 2. Northern white cedar partially seasoned.

Section 3. Northern white cedar green.

Section 4. Western red cedar fully seasoned.

Section 5. Western red cedar partially seasoned.

Section 6. Western red cedar green.

Owing to the difficulty of getting material with sufficient inner bark, six sections were taken for the experiment instead of twelve.

The diagram shows the distribution of the different areas in the stick:

Area A is the perforated unshaved surface.

Area B is the perforated shaved surface.

Area C is the non-perforated unshaved surface.

Area D is the non-perforated shaved surface.

Each area is one foot in length and extends entirely around the section at the points shown in the diagram.

Methods of Treatment

The sections were treated throughout their entire length for eight hours in hot oil and two hours in cold. The temperature of the hot creosote oil was 226° F. and that of the cold creosote oil 80° F.

After treatment each piece was cut into its various sections. Each section was quartered and measured at the center point for the penetration of creosote oil.

Observations After Treatment

Weather checks which would influence the penetration of the oil into the wood were carefully avoided in making these measurements.

Preparation of Sections for Treatment

SECTION 1. Northern White Cedar, Seasoned

Quarters	Penetration in 32nds of an inch 1	2	3	4	Average
Area A perf. unshaved	12	8	12	8	10
Area B perf. shaved	16	12	14	18	15
Area C unperf. unshaved	2	6	2	2	3
Area D unperf. shaved	6	2	4	2	3 plus

The difference in penetration in Areas A and B was due to the bark clogging the teeth of the machine. The oil in every case penetrated to the bottom of the perforations which were not as deep in the unshaved area as in the shaved area. The difference between Areas C and D was so small that it is within the range of experimental error in measuring.

SECTION 2. Northern White Cedar, Partially Seasoned

Quarters	Penetration in 32nds of an inch 1	2	3	4	Average
Area A perf. unshaved	12	16	16	16	15
Area B perf. shaved	16	16	16	16	16
Area C unperf. unshaved	2	3	2	4	3 minus
Area D unperf. shaved	3	4	3	3	3 plus

Areas A and B still show a difference of 1/32 inch due to bark clogging the teeth of machine. Areas C and D show a difference of not quite 1/32 inch in favor of the shaved surface. Oil penetrated completely through the bark at all measurements.

Section 3 was in a very green condition when treated. It was cut green in the woods, and shipped unpeeled. It was wrapped so that seasoning amounted to very little during shipment.

SECTION 3. Northern White Cedar, Green

Quarters	Penetration in 32nds of an inch 1	2	3	4	Average
Area A perf. unshaved	16	16	14	12	14 plus
Area B perf. shaved	16	14	18	16	16
Area C unperf, unshaved.	4	3	1	4	3
Area D unperf. shaved	4	1	4	4	3 plus

The penetration in area A was 1/16 inch less than in area B, due to the bark preventing the teeth entering the wood to their full depth. In areas C and A the oil had difficulty in penetrating through the green inner bark. The oil was observed in the wood underneath the bark yet there was a streak of uncreosoted fibre running through the middle portion of the bark.

SECTION 4. Western Red Cedar, Seasoned

Quarters	Penetration in 32nds of an inch 1	2	3	4	Average
Area A perf. unshaved	12	18	16	16	15 plus
Area B perf. shaved	14	16	14	16	15
Area C unperf. unshaved	14	8	8	8	9 plus
Area D unperf. shaved	10	14	8	6	9 plus

The difference between Areas A and B is very slight and is within the experimental error of measuring. No difference was shown between the unperforated unshaved area and the unperforated shaved.

SECTION 5. Western Red Cedar, Partially Seasoned

	Penetration in 32nds of an inch				
Quarters	1	2	3	4	Average
Area A perf. unshaved	14	16	12	12	13 plus
Area B perf. shaved	16	16	16	14	15 plus
Area C unperf. unshaved	2	2	3	2	2 plus
Area D unperf. shaved	2	3	2	2	2 plus

There is a difference of 1/16 inch in the perforated shaved and unshaved surfaces and no difference between the non-perforated shaved and unshaved surfaces.

The condition of the green section 6 was the same as that of the green northern white cedar described in section 3.

SECTION 6. Western Red Cedar, Green

	Penetration in 32nds of an inch				
Quarters	1	2	3	4	Average
Area A perf. unshaved	4	12	16	14	11 plus
Area B perf. shaved	18	12	16	16	15 plus
Area C unperf. unshaved	4	2	0	4	2 plus
Area D unperf. shaved	2	8	6	2	4 plus

In area C the oil did not penetrate through the inner bark leaving the wood fibre without visible trace of creosote. The perforated unshaved showed 1/8 inch less penetration than the perforated shaved area.

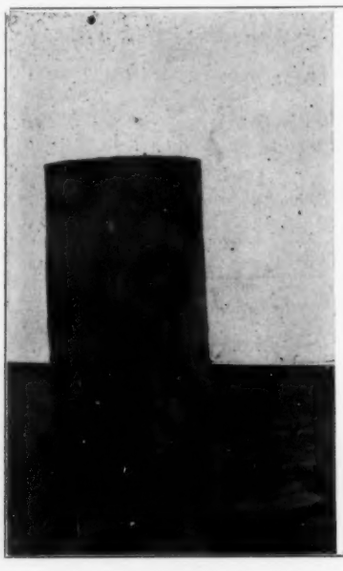


Fig. 1. Showing the inner bark pulled off from treated section. Note the white area showing absence of creosote.

Fig. 2. Showing how the inner bark is pulled loose by the perforating machine.

Conclusions

From the above observations it appears that the effect of the inner bark on the penetration of creosote oil into perforated wood is a mechanical one, resulting from portions of the inner bark coming loose and preventing the perforating teeth from going in their full length. The loss in penetration on all areas on account of the inner bark varied from 5/32 to 1/32 inch. In all cases the oil had apparently little trouble in penetrating the wood beneath the perforated bark.

The leaving of the inner bark on during treatment had no visible effect on the checking of the wood during treatment.

In non-perforated poles the bark problem becomes more serious. In partially seasoned and thoroughly seasoned poles there is some loss due to the presence of inner bark but this loss is very slight, varying in the observations above from 1/16 inch to nothing. In green poles and in poles where inner bark is bright green in color and adheres very closely to the wood, creosote oil has considerable trouble in getting through the inner bark, in some cases not penetrating at all, as in the case of the green sample of western cedar used in this experiment.

Wm. De Carteret Buys Exeter, Cal., Plant—Pays $28,000

Exeter, Cal.—J. G. Kirkman has sold the Exeter Telephone exchange to Wm. De Carteret for $28,000. Improvements recently ordered are to be made by Carteret.

Legion Post Buys Decatur, Ark., Telephone Company

Decatur, Ark.—Figuring that they might as well be first in peace as in war, the local American Legion post has bought the Decatur telephone exchange, and will overhaul the system.

OUR LITERARY DIGEST

Review of Recent Articles on Telephony and Allied Subjects

"Prehistoric Telephone Days," by Alexander Graham Bell, National Geographic Magazine, March, 1922.

Some time ago Mr. Bell delivered an address before the officials and examining force of the U. S. Patent Office. He has revised and largely rewritten this for publication in the magazine of the National Geographic Society of which he is a member of the Board of Trustees. The article is autobiographical and in the first part the author tells of his early life and his passion for music and nature study. He early became interested in the mechanism of speech through contact with his grandfather who founded the profession of correction of defective speech. Among the people who contributed to his development were Alexander J. Ellis, the translater of Helmholtz' monumental work on sound; Max Muller, the Sanskrit scholar; Sir James Murray, editor of the Oxford Dictionary; Prince Lucien Bonaparte and Sir Charles Wheatstone. The author describes his early experiments in the production of speech and the construction of an automaton which could produce a few simple sounds and tells a rather humorous tale of the dog who could say a few words if the jaw and throat were properly manipulated by the youthful experimenter, but who could only growl if left to himself. The article closes with an anecdote of the first use of the telephone for foreign language by a Japanese student and describes the surprise of the Oriental when he found that it would speak Japanese.

"The Practical Application of the Telephone Repeater," by H. S. Osborne. Journal of the Western Society of Engineers, May, 1922.

After pointing out the extremely small amount of power used in telephone circuits, the author suggests three practicable methods of increasing the range of transmission. Of the three, the telephone repeater is the most economical and satisfactory for application to long lines. He then gives a brief description of the mechanical and vacuum tube repeaters and the circuits used in their application to lines. The application of repeaters to the transcontinental line and to the cables between the United States and Cuba are described as well as the application to the projected long distance telephone cable between New York and Chicago.

RADIO MEET REPORTS

Report of Radio Telephone Conference Makes Important Recommendation

Washington, D. C.—The final report of the Conference on Radio Telephony held in Washington on April 17, 18 and 19 has been published. The recommendations made by the conference are based on the results of the preliminary conference held Feb. 27 to March 2 and upon the comments that were made on the tentative report of that meeting. The final conference prepared a report on technical matters and made recommendations as to essential points required in legislation to give the Secretary of Commerce authority necessary to accomplish the ends recommended.

The general resolutions adopted by the conference recommend that the Secretary of Commerce be given adequate legal authority for the effective control of the establishment of all radio transmitting stations except amateur, experimental and Government stations and that he shall have control of the operation of all stations except Governmental radio transmitting stations. It was further resolved that radio communication should be considered a public utility and as such should be regulated and controlled by the Federal Government in the public interest and that the types of radio apparatus most effective in reducing interference should be made freely available to the public without restriction.

The wave bands recommended that are of most general interest are the bands of 1,550 to 1,650 meters for fixed station radio telephony between stations separated by natural barriers; Bands from 1,050 to 1,500, 700 to 750, 650 to 700 and 485 to 495 meters reserved for government and public broadcasting; a band from 285 meters to 485 for private and toll broadcasting, and a band from 150 to 275 for the amateurs sharing the range from 200 to 275 with technical and training schools.

Among other recommendations of interest to telephone men is the recommendation that radio be used for point to point communication only in cases where effective communication can not be maintained by other means. This kind of communication should be carried on by wire lines wherever possible. In granting licenses it was recommended that first consideration be given to the public not reached by other means and that the order of priority be the services of Government, Public, Private and Toll. Direct advertising by radio is to be limited to the statement of the name of the firm responsible for the matter broadcasted if the recommendation of the conference is followed.

The status of the amateur was given extended consideration and it was recommended that his status be established by law and the limits of the wave band specified. It was further recommended that Deputy Radio Inspectors might be appointed from among the amateurs who would have such duties in policing the district to which he is assigned to prevent undue amounts of interference. Numerous recommendations were made regarding the study by the Bureau of Standards of many technical points involved.

NEW EDITION ON RADIO

Government Book Mentioned in May TELEPHONE ENGINEER Displaced by Later One

Dr. S. W. Stratton, Director of the Bureau of Standards calls TELEPHONE ENGINEER'S attention to the fact that the first edition of "Principles Underlying Radio Communication" is out of print.

A revised, and considerably enlarged edition of the government publication of this title can be purchased for $1.00 from the Superintendent of Public Documents, Government Printing Office, Washington. The new edition contains more than 600 pages and 300 illustrations. The book will give anyone having general familiarity with electricity a good foundation in the principles of radio communication. The publication is considered a standard authority.

Radio Craze Brings Raids On Telephones for Equipment

Chicago, Ill.—From all parts of the United States telephone companies are complaining about the forays amateur radio operators are making on public telephones in order to secure equipment they think will be suitable for their outfits. The seclusion of a telephone booth affords a good opportunity for the radio nut to acquire a receiver. The thrifty and unprincipled parties are greatly disappointed with results of sets equipped with ordinary telephone receivers—they won't work on the wireless sets. Telephone men are hoping the daily newspapers will tip off their readers to this fact and cut down the losses of telephone equipment.

Government Book Tells How to Make $10 Radio Set

Washington, D. C.—Circular of the Bureau of Standards, No. 120, entitled "Construction and Operation of a Simple Home-Made Radio Receiving Outfit," may be obtained by sending five cents to the Supt. of Documents, Government Printing Office, Washington, D. C. The construction of a very simple radio receiving equipment for radio communication on wave lengths between 600 and 200 meters from high-power stations within fifty miles is described. This set may be easily constructed by anyone from materials which can be easily secured. The total cost of this equipment need not exceed $10. A single circuit, with a crystal detector and an inductor variable by steps, are used. Instructions are given for the construction of the crystal detector, inductor, necessary switches, antenna, and other parts. Certain parts, such as the telephone receivers must be purchased. Directions for operation are also given.

Bell Completes Highest Radio Broadcasting Station

New York City.—Two steel spires atop the 24-story Walker-Lispenard building, the peaks of which are 490 feet above street level, constitute the outward indications of America's highest radio station. This station has been constructed by the A. T. & T. Co.

Wisconsin U Lectures on Radio Well Attended

Madison, Wis.—Fifty telephone men, representing Wisconsin telephone companies attended the series of ten lectures on the radio telephone given by Prof. E. M. Terry, of the University of Wisconsin's physics department.

Yale, Okla., Company Now Has Radio Service

Yale, Okla.—L. W. Scherer, manager of the Yale, Okla., Telephone Co., is said to be the first independent telephone man in the state to install radio equipment in connection with his exchange. Yale subscribers are hearing concerts and news broadcasted from Pittsburgh, Detroit, Denver and Indianapolis.

New Building for Plattsburg, N. Y., Mountain Home

Plattsburg, N. Y.—Property has been acquired by the Mountain Home Telephone Co. for a new general office building. Construction will be started in a few months.

Western Penn. Staters to Meet July 20-22, at Conneaut Lake

Erie, Pa.—Western companies of the Pennsylvania Independent Telephone and Traffic Assn. will meet at Conneaut Lake, July 20-22. John Z. Miller of Erie is chairman of the program committee in charge of the event. Other members of this committee which plans to make the event a magnet for telephone men are, F. R. Rosboro, Uniontown, Fred J. Heavens, Pittsburgh, Lloyd Wright, Meadville, and H. E. Bradley, Harrisburg.

Up State New York Sets Dates for Summer Meetings

New York City.—Directors of the Up State Telephone Assn. of New York have tentatively decided upon the following dates for summer meetings: Cooperstown, June 15th, Vice-President H. W. Fluhrer, presiding; Lake Placid, July 14th, Vice-President B. H. Brooks, presiding; Alexandria Bay, August 17th, Vice-President; F. S. Rodenhurst, presiding.

Northern Indiana At Lake Wawasee, June 14-16

Lake Wawasee, Ind.—Last summer's convention of the Northern Indiana Telephone Assn., held at this resort, went across so well that the organization has decided to return with its 1922 summer affair. The dates chosen are June 14-16. Operators are to have a part in the proceedings.

Central N. Y. Independents Form Association

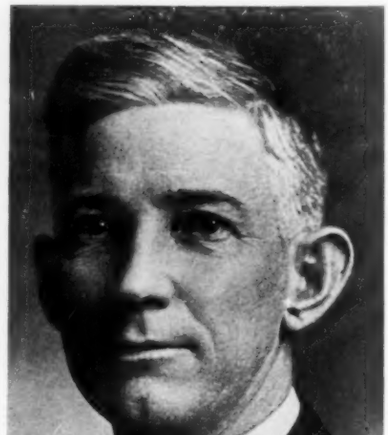
Utica, N. Y.—Independent telephone companies of central New York state have formed the Central New York Independent Telephone Association. The organization now covers only three counties, but plans rapid expansion in its territory. Fred C. Smith of Vernon is president, and Howard Wilcox of West Winfield, secretary of the association. Directors are Wendell Brown, Leonardsville; H. W. Tooke, Munnsville; and F. J. Crandall, Oriskany Falls.

F. C. Robideaux New Boss at Tuscola, Ill.

Tuscola, Ill.—F. C. Robideaux, of St. Louis, has succeeded J. W. Hamilton, for 17 years manager of the Douglas Telephone Co. of Tuscola. Hamilton continues with lightened responsibilities, as cashier. Hamilton's health was the cause of his request for relief. Under his management the company practically doubled in size. Considerable construction work is slated for the near future by the Douglas company.

Missouri Gets R. W. Hedrick as New State Secretary

Kansas City, Mo.—R. W. Hedrick has resigned as corporation attorney in the Missouri state department to become secretary of the Missouri Telephone Assn. Mr. Hedrick is a native of Iowa, and was associated with the Burlington railroad for a considerable part of his business career. He represented Benton county as a member of the House in the 48th and 49th General Assembly. Although Mr. Hedrick



R. W. Hedrick
Missouri's New Secretary

has had no specific telephone experience prior to his appointment as secretary of the Missouri organization, he is closely in touch with Houck McHenry, president of the organization, and with McHenry as mentor is expected to get the hang of things quickly. Hedrick holds a state wide reputation for being a regular fellow and is regarded as a prize addition to the association.

W. L. Ford Rises in World—Now Boss at Eldorado, Ill.

Eldorado, Ill.—W. L. Ford now is president and general manager of the Eldorado Telephone Co. He was, until recently, superintendent of the Murphysboro, Ill., Telephone Co. Ford has spent 20 years in the telephone business, 12 of them being served as superintendent at Murphysboro where he was tendered a banquet as he closed his local career.

C. W. H. Beyer, Iowa Magnate, Dies in City He Helped Build

Grinnell, Iowa.—Charles W. H. Beyer, director and treasurer of the Interior Telephone Co. of this city, and father of Harold L. Beyer, president of the Interior company, died here recently, having been in failing health for a year. Mr. Beyer was born in Prussia and was brought by his family to the U. S. in 1855. His farm loan interests decided him upon residence in Grinnell in 1877 and since that time he took an active and important part in building the community. Grinnell financial institutions were closed during the funeral. Mr. Beyer was prominent in financial and club affairs in the middle west.

Guy Boyle Posted as Bell Head at Anderson, Ind.

Anderson, Ind.—Guy A. Boyle, of Indianapolis, has been appointed Anderson manager of the Indiana Bell Telephone Co. He has been with the Hoosier Bell for 15 years.

Claude Long, Missouri Assn. Secretary, Resigns

Kansas City, Mo.—Claude D. Long, for several years secretary of the Missouri Telephone Assn., has resigned and will move to California with his family. His resignation was received with an expression of sincere regret by the executive committee of the association, which commended his services to the organization.

"Central" Right Hand Man of N. J. State Police

Trenton, N. J.—Through an arrangement with the New York Telephone Co. all calls for New Jersey State Police will be connected to the nearest quarters of the troopers, as a regular toll message. Similar arrangements are in effect in New York state.

Missouri Association to Meet Latter Part of Year

Kansas City, Mo.—H. L. Harris, W. H. Bassett, and G. V. Ross have been appointed to name the time and place of the next meeting of the Missouri Telephone Assn. The meeting will be held sometime in November or December, according to present plans.

Telephone Pioneers Pick Sixth City as Convention Point

Cleveland, Ohio.—September 29th and 30th have been chosen as the dates for the annual convention of the Telephone Pioneers of America, which is to be held in Cleveland this year.

Some Tips from "Team Work"

Commercial Superintendent of New England T. and T. Shows How Outgrown Routine Is Corrected by Suggestions Submitted by Employees Who Have the Right Perspective

By Lambert N. Whitney

I wish to speak simply as a member of the telephone family—to speak neither for the management as a whole nor for the Commercial Department in particular. The value of what I shall say comes largely from my experience during the years that I have been associated with the Bell Telephone System, and which establishes the firm belief that it is the real desire of our management to consider always, and to adopt whenever possible, any suggestions from any employee or patron, intended to assist in maintaining a satisfactory and business like telephone service; and the further belief that both employees and patrons are overlooking an important opportunity for such suggestions.

Counsel Solicited

Now as to the first belief; let's take a few minutes and review a well-known instance where a great many suggestions of employees and patrons have been adopted. I shall refer to an instance in the Commercial Department, solely because I am more familiar with that, and not at all because similar conditions do not exist in all departments.

Several years ago, in connection with our special efforts to provide for a better commercial service, we arranged for the division superintendents to have no office force and not more than three districts. This permits their constant personal study of local conditions with their local people, and supplemented by the fact that the territory of the Company is small enough to permit similar conference with the general staff, provides a direct and active contract between the general office and the field forces, and through the field forces to our patrons. This encourages us all to really think about our service, discuss its "whys and wherefores" with both our associates and our patrons and make such suggestions for improvements as naturally result from such a procedure.

The development of this idea—of more counsel with our field forces and patrons—followed two quite distinct lines. At first we urged all employees to interest themselves in why their individual work was performed at all, and why in a specific way; this with particular reference to avoiding work that had become unnecessary, but which had been more or less perfunctorily continued from the past. This process was carried on under the direction of the engineer of commercial methods. The results were surprisingly satisfactory, for we developed many short cuts and savings in the practices for handling our contract and collection work and discovered many unnecessary forms, routines, etc. In spite of the war-time increases in wages and other expenses, we obtained the remarkable result that our expense per unit was materially reduced and at the same time our work was better performed. The scope of this work of soliciting the active assistance of the field employees under the direction of the engineer of commercial methods was then enlarged to include studying and arranging with the field forces for modifications of the commercial practices that were desired by our patrons. Here again many valuable suggestions were easily and naturally developed and adopted; and as a result of this procedure we obtained a simple and comprehensive set of practices that avoids set operations, and is flexible enough to allow an easy and natural application that provides for a good administration of the commercial work, without conflicting with the varying characteristics of those we serve.

Together these two procedures not only provide for economical commercial methods that allow the field forces to deal satisfactorily with a specific case in different ways, depending upon the patron and circumstances involved, but they also result in a set of practices that develops interest in our work. For, as a general proposition, the practices tell what we wish to do and why we wish to do it, leaving the detailed process of how to do it largely to those handling the specific case in question. This naturally develops a feeling of responsibility and initiative on the part of the employees that results in an interest and pride, that in turn increases our ability to see, think, generate new ideas, and continually develop practices that make general progress, individually and collectively.

Furthermore, due to our individual participation in the development of our practices, our interest in the proper execution of such practices is necessarily better, and we thus help greatly in avoiding suggestions that it is impracticable to carry out. We thus build up, step by step, through individual thought, conferences with associated departments, counsel with our patrons and discussions with the so-called engineer of commercial methods, good general practices covering the sales end of our business. So much for the confirmation of the first belief to which I referred at the beginning; I think you will all agree with me that it is clearly a fact, and that the reasons for it are obvious.

Opportunity for More Suggestions

Now as to the second belief—the fact that we are overlooking an important opportunity for further suggestions—that is a little longer story. To develop this, let's start out with the fact that fundamentally all business is the same and has the two distinct and separate factors of production and sales. While there may be some unusual characteristics, there are no commercial anomalies in our business; it is not exempt from either the laws of political economy or general business; and it has the two processes of production and sales to an extent that will probably eventually result in having our organization so divided, in accordance with general business practices. Furthermore, these two processes—production and sales—are so closely associated with balance sheets—the real indicators of success—that they must both be conducted with a high degree of thought as to business fundamentals.

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must consider the requirements and characteristics of the patrons involved and must assist in determining whether the costs of our specific products (classes of service) and their associated prices (rates) are properly related to the value of the products to the patron. This requires an ample margin between the cost to the Company of producing the product and the value of the product to the patron; for between the two must lie the price (rate); and to be a stable rate (that is, satisfactory to both patron and producer) there must be a substantial margin from the rate up to the value of the product to the patron and likewise a substantial (but not equal) margin from the rate down to the cost to the Company of producing the product.

Whether or not our business is stable depends, therefore, not alone upon continuing an efficient selling of a specific product (development), but also upon possible changes in the product that will improve the relation between its cost of production and its value to the patron. The maintenance of proper results of operation (balance sheet) cannot be continuously secured by development alone nor by mere changes in the level of prices (rates), unaccompanied by changes in the product (service) any more than the improvements in our sales methods were obtained by doing the same work more efficiently without changing the work itself.

A prerequisite for business success is that any avoidable production expense be eliminated, otherwise we can neither be sure of a return upon our capital nor even the capital itself. I believe that this commercial feature of engineering changes in our product, is way behind our construction, operating and selling engineering for specific products, and of which we are all so proud. In other words, I question whether we have given enough attention to associating the general characteristics of the service which a given community is receiving, with the service that is really required and the corresponding plant and operating costs. To do so would seem to be a clear business matter, and it is this consideration of changes in our product that is the opportunity I think we are missing.

Let's take a minute and see how businesslike and important this opportunity really is for us. On account of the magnitude of our service and the enormous extensions that are before us, the total money involved in small changes in our product may be very great, and it is, therefore, essential to our success that our product be supplied with great regard for the relation between its costs to us and its value to our patrons.

The fact that this relation between production cost and value of the product is becoming more and more important, also develops through the many ways that society and business in general are changing in our different communities. These changes also involve a conspicuous tendency on the part of our patrons toward thrift, the avoidance of waste, saving, general economy, the adoption of less expensive habits, an analysis of the production costs of successful producers, etc.; and our product, which is used by everyone, is thus becoming subject to searching scrutiny, to be sure that cost cannot be rduced and still provide a satisfactory product. Especial care is also required to provide properly for this relation, because we have a rapidly developed business and our problems are becoming more intricate. Such conditions naturally provide opportunities for the elimination of costs that did not seriously disturb this balance, between costs and value, when revenues and capital were comparatively small and easily obtained, but which become more and more im-

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portant as our production increases so enormously. We, therefore, must not perfunctorily continue our development of specific classes of service until we are reasonably sure there are no modifications of the service that will improve this relation between costs and value.

Modifications Differ in Communities

Now as to the fact that we are all involved in this opportunity for further suggestions regarding modifications in our products. A mathematical, uniformly applicable formula for providing the proper relation between costs and values might have been possible when our business started, but it is no longer possible; for our present products are the results of so many years of testing, experimenting, using, etc., that they are an integral part of modern life. They can no more be made over at this late date to arbitrarily conform to theoretical perfection than we can make over a large city. They can, however, be modified in many specific instances on varying practical bases to conform with the practices and characteristics of the communities served.

The proper relation is, therefore, to be obtained in different ways in different communities, depending upon the people involved; and we must, therefore, provide liberal opportunity for our patrons to express freely and continuously the value of varying degrees of such elements of our product as—extent of development, dependableness and quality of operating, dependableness and quality of transmission, etc. These values must obviously be obtained through counsel with our patrons by our field forces. Then, knowing such values, we must balance them with the corresponding production costs, and these costs obviously involve us all (Plant, Traffic, Commercial, Accounting, etc.)

Only in some such way as this may we guard against production practices that result in an extensive unbalanced property which will fall when, through free and natural discussions and exchange of ideas in a search for reduced prices, the fact is developed that changes in our product (having far-reaching effects) are required. This is conspicuously before us in connection with machine switching methods, where failure to associate production costs with service values may not only cause severe losses by reason of changes which will have to be made, but also because of loss of earnings during the intervening period.

(Concluded in next issue)

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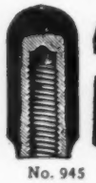
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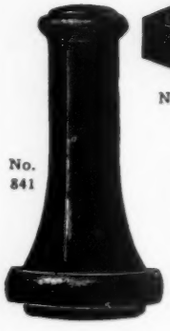
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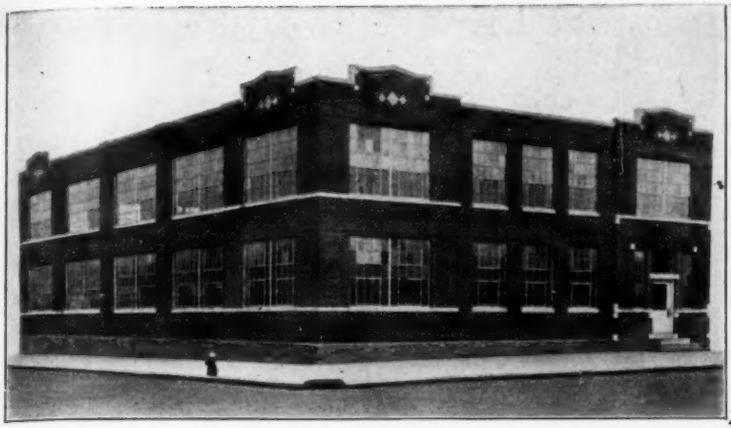

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London, England—A reduction of cost from 50 per cent to 75 per cent, and secret and uninterrupted service to each subscriber is the offer of the Hasting's party line telephone system representative now being considered by the G. P. O. authorities.

Gonzales, Tex., to Blossom in New Exchange

Gonzales, Tex.—Ground has been broken for the handsome new exchange of the Gonzales Telephone Co. With an even break in luck the new building will be occupied by a completely modern exchange July first.

Telephone Dispatching on British Railways

London, Eng.—Recent reports of the substitution of the telephone for the telegraph on the London and S. W. railway indicate that the use of railway telephones for the control of train operation, a feature of American railway practice for a number of years, has spread to foreign countries.

"Juce" for Curing Storage Batteries Arrives

Kansas City, Mo.—Announcement of "Juce," an electrolyte which is said to cure many of the ills of storage batteries, has been made by the Welborn corporation of this city. Remarkable success in increasing and prolonging efficiency of storage batteries has been registered in the first tests of "Juce" and its inventors are studying its performance in the automobile industry with a view of extending their activities to the telephone business.

Idaho's Bit of Mountain States' Construction Money, $443,000

Boise, Idaho.—H. R. Risley, state manager of the Mountain States T. & T. company, states the company has decided to spend $443,000 on its Idaho plants in 1922.

The installation of a copper circuit between Emmett and Cascade at a cost of $40,000, is one of the new pieces of work to be done. Approximately $75,000 will be spent in Pocatello for new work, much of which, according to the manager, will be underground. Long distance and local telephone improvements at the Payette switchboard, at a cost of $5,000, will also be made.

Roving Creosoting Plant

(Concluded from Page 19)

with vaseline to save his skin from the effects of the creosote which has a tendency to peel it off. The lights and shadows were so sharp that the men had to be particularly careful in this night work to avoid accidents and it was a relief to discontinue it for the two-tank method.

The third method was to use one shift of men and two treating tanks, with an eight-hour hot and eight-hour cold treatment, the hot oil being drawn off on completion of the eight-hour period and cold oil run in immediately. This method proved the most satisfactory. With the two tanks 44 Class "B" 30 ft. or Class "A" 25 ft. poles could be treated in a day, and allowing for a reasonable number of moves, 10,000 Class "B" 30 ft. poles or approximately that number of assorted sizes could be treated in a year with this plant.

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